FORESTRY ABSTRACTS

VOLUME 7 1946 NUMBER 4

A NEW ABSTRACT SERIES

FOREST PRODUCTS AND UTILIZATION

SINCE its inception in 1938 the Imperial Forestry Bureau has covered the forestry literature of the world by means of its quarterly journal, *Forestry Abstracts*, now completing its seventh volume. The abstracts of the separate literary contributions are classified according to the International Decimal System, the major divisions of which correspond roughly to the general subjects of Forest Policy, Silviculture, Management, Protection, Utilization and Allied Sciences. From the viewpoint of the professional public served by the Bureau these subjects can be regrouped into two main fields, one of which deals with the living forest and the *production* of wood, and the other of which deals with the *utilization* of wood and all other forest products. In general each field interests primarily its own group of technicians, industrialists and research workers, who greatly outnumber a third group interested in the entire field of forestry in the widest sense. To satisfy their diverging interests it is intended to divide *Forestry Abstracts* into two series, each of which will be published separately (but concurrently) at quarterly intervals; each series may be subscribed to separately.

An additional reason for sub-division is the continuous growth in volume of the literature, already greatly increased by the conclusion of the war, and, particularly, by the marked developments in the utilization of timber. The first volume of *Forestry Abstracts* contained 319 pages and 1702 abstracts; the seventh volume has 590 pages and 2204 abstracts. With more complete coverage of the literature on the utilization of all forest products, together with their research and industrial aspects, it is anticipated that there will be material enough to justify two separate abstract journals.

In order to meet this demand a sub-section of the Imperial Forestry Bureau is being built up at the Forest Products Research Laboratory, Princes Risborough, England. This agency will deal exclusively with forest products and utilization, will abstract and review the literature, will answer enquiries in this field that are addressed to the Bureau, and will provide English translations of technical papers in foreign languages.

The new series will be issued concurrently with Vol. 8, No. 1 of *Forestry Abstracts* in September, 1946, under the subtitle of '*Forest Products and Utilization*'. Its contents correspond exactly with the decimal section 3 of *Forestry Abstracts*, i.e. Forest Utilization: Forest Technology. For the twelve months during the currency of volume 8 the new series will be published as an extra impression *in addition* to *Forestry Abstracts*, which will continue to appear in complete form as before. Final division into two separate series will probably be made with volume 9 in 1947.

Valuable suggestions as to the scope and improvement of the new series of abstracts on forest products and utilization have been received from forest departments and research laboratories in the Empire. Further opinions and criticisms will be welcomed from the timber trade and all industries based on wood and its by-products and on the minor products of forests. Those interested in its abstract journals and in the service the Forestry Bureau is able and anxious to give are invited to communicate with the Director.

The annual subscription to Section 3 *Forest Products and Utilization* is 10*s.* 0*d.*; single parts 3*s.* 0*d.* All correspondence regarding subscriptions should be addressed to:—Imperial Agricultural Bureaux, Central Sales Branch, Agricultural Research Building, Penglais, Aberystwyth, Great Britain.

THE FOREST INSTITUTE OF THE ACADEMY OF SCIENCES OF THE U.S.S.R.

Recognition in the U.S.S.R. of the need for co-ordinated studies of the biological aspects of forestry, arising in the first instance mainly from a realization of the value of forests in soil and water conservation, has continued to grow in recent years, and what appears to be a step of great importance has now been taken in the establishment of a central institute for forestry research under the authoritative Academy of Sciences. The background and aims of the new body have been described by its Director, Academician V. N. Sukachev, and its Deputy Director, Prof. P. V. Vasil'ev, in recent articles [1, 2] of which the following is a summary.

The creation of such an institute was proposed in 1939 by a group of lecturers at the Leningrad Forest-Technical Academy, and the question was again raised during the war by members of the Urals Forest-Technical Institute, the Urals group of the Academy of Sciences and the heads of the Central Forest Protection Board and the Central Board of Timber Supply. In February, 1944, the Presidium of the Academy of Sciences carried the necessary resolution and the Forest Institute began its work on 1st September of that year. Research institutes had already existed for many years under the Commissariats of Forest Industry and Agriculture, under the Central Forest Protection Board, and as individual bodies in some of the republics; in addition, the larger teaching institutions had research sections. It was, however, considered that these could not guarantee research on a sufficiently broad and at the same time detailed basis, hence the necessity for a large, central, extra-departmental institution to deal with fundamental problems requiring profound theoretical elucidation and a broad, complex, yet unified research programme based on uninterrupted study by teams of experts in diverse conditions, demanding a wide territorial coverage and not hampered by departmental considerations. These needs have been further emphasized by the effects of the war; for in view of the destruction of millions of hectares of forest and nurseries in the German-occupied areas—leaving much of the remaining forest in a crippled and insanitary condition, disturbing the water regime and encouraging erosion—and of the increased demands upon the forest in the unoccupied zones, the problems of rehabilitation and general improvement of forestry practice have become nation-wide.

Though timber is the chief forest product, the importance of minor products and beneficial forest influences is very considerable. The aim of forestry should be to obtain all these benefits in full, in perpetuity, and with the least expenditure of effort and financial means, a task which can be fulfilled only by learning to direct the complex life of the forest as a whole. Sukachev, who has long been one of Russia's leading ecologists, insists that investigation and the application of its results must therefore be built round the concept of the forest as a series of 'biogeocoenoses' in which plant life, animal life and the environment are integrated in diverse ways.

The tasks of the new Institute will fall into the following main groups:—(i) *Theory and methods of selection and acclimatization,* for the improvement of existing forests and the afforestation of war-devastated lands and the vast areas of steppe, desert, alkaline soils, etc. The basis for selection must be established by careful research on (*a*) species and forms growing under natural conditions; (*b*) all available herbarium material; (*c*) species and forms in cultivation (experimental systematics); (*d*) anatomy and cytology; (*e*) mapping of areas of distribution; all this to be accompanied by studies of comparative ecology, in nature and under cultivation, and the development of rapid methods of propagation. Particular stress must also be laid on the synecology of trees, since eventual selections must be grown in forest stands. (ii) *Physiology and ecology*, under conditions in the stand, in different forest types, and as individuals. Important aspects in this field are the hydrological role of forests and the physiology of wood formation as regards both quality and quantity. Together with synecological studies, such research is fundamental to the modification of natural coenoses or the creation of new and improved forest communities. The main species should be investigated in the first place, but work on others may be needed for the solution of individual problems. (iii) *Investigation of the forest biogeocoenosis as a whole*: (*a*) Interactions of plants, including cryptogams, among themselves, and particularly studies of aerial and subterranean competition in natural forest, in forest subject to some human intervention and in plantations; (*b*) interactions of plants, soils and climate, with particular emphasis on the role of forest litter and the microclimates of each layer of the forest and soil; (*c*) interactions of the plant and animal worlds and of animals with their environment; (*d*) the cycles of chemical materials and energy in the biogeocoenosis; (*e*) the dynamics of the biogeocoenosis, i.e. developmental and successional aspects, including the history of communities at least from the end of the Tertiary period, and covering both natural and man-made changes. (iv) *Forest 'typology'*, i.e. the essentially classificatory problem of forest types, on which a large literature already exists but which is still hotly debated. Here the fundamental unit must be not the phytocoenosis but the biogeocoenosis, and the problem must be attacked by teams of specialists. Further, since wood is the chief product and differs according to the conditions of the community in which it is grown, the investigation of its chemical and physico-mechanical properties must also be related to forest types, accompanied by pathological investigations, and linked with the genetic and systematic work to be undertaken.

In this complex of problems the unifying concept must be that of the biogeocoenosis, and the aim ultimately to determine and put into practice the chief measures needed in applied forestry, the whole being considered in turn from the angle of forest economics and the future rationalized development of forestry in the best interests of national and regional economy. The latter aspects will be the chief concern of the silvicultural and economic sections of the Institute, and a primary requisite will be the compilation of silvicultural and economic maps of the forests of the U.S.S.R. A probable future task of the economics section, in collaboration with the Institute of Economics of the Academy of Sciences, would be studies of the world timber market and timber reserves, world utilization of wood products, etc. The Forest Institute ought also to study the history of silvicultural concepts in relation to social and economic conditions, a branch of knowledge that has been much neglected.

The framework of problems as outlined will doubtless be extended as time goes on. Special questions that will occupy the Institute will be the relations between forest and swamps and the problem of waterlogging on felling sites, the die-back of forests in the southern and south-eastern regions and other major problems that may arise.

Finally, it should fall to the Forest Institute to co-ordinate forestry research in departmental and teaching institutions, to provide an authoritative lead and to prevent duplication of effort. To this end annual pan-Soviet conferences for the discussion of results and future work are envisaged. On the other hand, the Institute must consult the State authorities on questions demanding authoritative scientific research, and seek the co-operation of other Institutes, and of the Moscow Botanic Garden of the Academy of Sciences. It will be necessary to build up a staff of the best qualified specialists in the various branches of forestry. Two experimental forest districts, the Serebryanȳ Bor near Moscow and the Tellerman plantation in the forest-steppe zone, Voronezh Province, have so far been made available to the Institute.

As at present organized [2, 3], the Institute has the following sections:—(i) A *Laboratory of Genetics and Selection*, headed by Prof. L. F. Pravdin, which has begun work on the selection of valuable strains of Pine, Larch and *Euonymus* and has organized an expedition to study Larch types in the region where the Siberian and Dahurian Larches meet. (ii) A *Laboratory of Physiology and Ecology*, under Prof. L. A. Ivanov, which has so far been engaged in actinometric studies and research on transpiration of Pine in the Serebryanȳ Bor. (iii) A *Laboratory of Biocoenology and 'Typology'* under the Director of the Institute, which is carrying out a study on anatomy in relation to ecology of Pine in the Serebryanȳ Bor and studies in the Tellerman Plantation on the wood chemistry and physico-mechanical properties of Oak in relation to forest types. (iv) A *Laboratory of Silviculture*, directed by Prof. M. E. Tkachenko, under whom various workers are making a general study of the Tellerman Plantation and doing research on die-back of forests in the south and south-western regions, on Pine root systems in relation to windthrow on sandy areas in the neighbourhood of Moscow and on hydrological conditions in forests on sandy areas. (v) A *Laboratory of Pathology*, under Prof. S. I. Vanin, working on Oak and Ash fungi in different forest types and on the ecology and parasites of Cerambycids of conifers in the Prokudin Bor. This section is also planning an entomological investigation of forest types in the Tellerman Plantation and investigations on biological aspects of timber utilization. (vi) A *Forest Survey Bureau,* under Prof. P. V. Vasil'ev and M. Rastsvetaev, which is stated to have developed a new method of compiling maps of the forest zones of the U.S.S.R. and to be preparing a manual of forestry.

V. B.
P. G. B.

REFERENCES

[1] SUKACHEV, V. N. Institut lesa Akademii Nauk SSSR i ego zadachi. [The Forest Institute of the Academy of Sciences of the U.S.S.R. and its tasks.] *Vestnik Akademii Nauk SSSR* 15 (1/2), 1945 (34–45). [Russ.]

[2] VASIL'EV, P. V. Izuchenie lesa v sisteme Akademii Nauk SSSR. [Forest research under the Academy of Sciences of the U.S.S.R.] *Lesnaya Prôm.* No. 9, 1945 (12–4). [Russ.]

[3] SHIMANIUK [SHIMANYUK], A. The Soviet Wood Institute. *Wood* 11 (2), 1946 (58).

ABSTRACT SECTION

NOTE.—A capital letter in square brackets following the reference denotes the language in which the paper is written. A small letter denotes a summary in another or the same language, e.g. [G.e.]—German, with English summary. English [E.] is only indicated for papers published in journals usually written in foreign languages.

The term "billion" used in papers originating in North America means a thousand million.

0. GENERAL FORESTRY

05. PERIODICALS

05.3. *Annual Reports*

05.3 (410) : 33.51. GREAT BRITAIN. **Ministry of Fuel and Power: twenty-third annual report of the Safety in Mines Research Board, 1944.** H.M. Stationery Office, London. 1945. pp. 30. [1500].

05.3 (410) : 07.2. GREAT BRITAIN. **Annual report (thirty-second year), 1944: East Malling Research Station, near Maidstone, Kent, 1st January, 1944, to 31st December, 1944.** The Kent Incorporated Society for Promoting Experiments in Horticulture. No. A28, 1945. pp. 137. [1501].

05.3 (410) : 07.2. GREAT BRITAIN. **Supplementary annual report (thirty-second year). General development and activities: East Malling Research Station, near Maidstone, Kent, 1st January, 1944, to 31st December, 1944.** The Kent Incorporated Society for Promoting Experiments in Horticulture. *Misc. Publ.* No. A28, 1945. pp. 17. [1502].

05.3 (485) : 94.1 : 09.4. SWEDEN. Domänverket år 1940 av Kungl. Domänstyrelsen. **[Work in the State Forests, 1940, by the Royal State Forestry Board.]** *Sveriges Officiella Statistik.* Kungl. Boktryckeriet. P. A. Norstedt and Söner, Stockholm. 1941. pp. 243 + map. [Sw.] [1503].

05.3 (485) : 94.1 : 09.4. SWEDEN. Domänverket år 1941 av Kungl. Domänstyrelsen. **[Work in the State Forests, 1941, by the Royal State Forestry Board.]** *Sveriges Officiella Statistik.* Kungl. Boktryckeriet. P. A. Norstedt and Söner, Stockholm. 1942. pp. 116. [Sw.] [1504].

05.3 (485) : 94.1 : 09.4. SWEDEN. Domänverket år 1942 av Kungl. Domänstyrelsen. **[Work in the State Forests, 1942, by the Royal State Forestry Board.]** *Sveriges Officiella Statistik.* Kungl. Boktryckeriet. P. A. Norstedt and Söner, Stockholm. 1943. pp. 116. [Sw.] [1505].

05.3 (485) : 94.1 : 09.4. SWEDEN. Domänverket år 1943 av Kungl. Domänstyrelsen. **[Work in the State Forests, 1943, by the Royal State Forestry Board.]** *Sveriges Officiella Statistik.* Kungl. Boktryckeriet. P. A. Norstedt and Söner, Stockholm. 1944. pp. 118. [Sw.] [1506].

05.3 (485) : 94.1 : 09.4. SWEDEN. Domänverket år 1944 av Kungl. Domänstyrelsen. **[Work in the State Forests, 1944, by the Royal State Forestry Board.]** *Sveriges Officiella Statistik.* Kungl. Boktryckeriet. P. A. Norstedt and Söner, Stockholm. 1945. pp. 116. [Sw.] [1507].

05.3 (485) : 94.3 : 09.4. SWEDEN. Det enskilda skogsbruket år 1942 av Kungl. Skogsstyrelsen. **[Private forestry in 1942, by the Royal Forestry Board.]** *Sveriges Officiella Statistik.* Centraltryckeriet Esselte ab. Stockholm. 1944. pp. 37 + 20 tbls. [Sw.] [1508].

05.3 (485) : 94.3 : 09.4. SWEDEN. Det enskilda skogsbruket år 1943 av Kungl. Skogsstyrelsen. **[Private forestry in 1943, by the Royal Forestry Board.]** *Sveriges Officiella Statistik.* Centraltryckeriet Esselte ab. Stockholm. 1945. pp. 41 + 21 tbls. [Sw.] [1509].

05.3 (485) : 94.3 : 09.4. SWEDEN. Det enskilda skogsbruket år 1944 av Kungl. Skogsstyrelsen. **[Private forestry in 1944, by the Royal Forestry Board.]** *Sveriges Officiella Statistik.* Centraltryckeriet Esselte ab. Stockholm. 1946. pp. 106. [Sw.] [1510].

05.3 (54 : 59.1) : 07.2. INDIA AND BURMA. **Forest research in India and Burma, 1942–43. Part I. The Forest Research Institute.** The Forest Research Institute, Dehra Dun. [1943?] pp. 144. [1511].

Reports on the year's work at the Institute for the various sections, with a general summary, and a list of publications up to the end of 1943.

05.3 (54.7). SIND. **Annual administration report of the Sind Forest Department for the year 1943–44.** Govt. Press, Karachi. 1945. pp. viii + 21. [1512].

05.3 (54.87). CEYLON. **Silvicultural research administration, 1943.** Typescript. 1945. pp. 14. [1513].

05.3 (68.9). NORTHERN RHODESIA. **Department of Agriculture: annual report for the year 1944.** Govt. Printer, Lusaka. 1945. pp. 12. [1514].

05.3 (69). MAURITIUS. **Annual report of the Forest Department, 1944.** Govt. Printer, Port Louis. 1945. pp. 12. [1515].

05.3 (71) : 07.2. CANADA. **Twenty-eighth annual report of the National Research Council of Canada, 1944–45.** National Research Council, Ottawa, Canada. 1945. pp. 40 + 45. [E.F.] *N.R.C.* No. 1342. [1516].

05.3 (71) : 44.3 : 44.4 : 42.5. CANADA. **Twenty-fourth annual report of the Canadian Plant Disease Survey, 1944.** Division of Botany and Plant Pathology, Department of Agriculture, Dominion of Canada. 1945. pp. xviii + 122. [1517].

05.3 (71.11). ALBERTA. **Annual report of the Department of Lands and Mines of the Province of Alberta for the fiscal year ended March 31st, 1944.** King's Printer, Edmonton. 1945. pp. 127. [1518].

05.3 (728.2). BRITISH HONDURAS. **Report of the Forest Department for the year ended 31st December, 1944.** Govt. Printer. [Belize?] 1945. pp. [13]. [1519].

05.3 (729.7). TRINIDAD AND TOBAGO. **Forests. Administration report of the Conservator of Forests for the year 1944.** *Council Paper* No. 31, 1945. pp. 6. [1520].

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05.3 (88.1). BRITISH GUIANA. **Report of the Forest Department for the year 1944.** Govt. Printer, Georgetown, Demerara. 1945. pp. 4. [1522].

05.3 (931). NEW ZEALAND. **State Forest Service: annual report of the Director of Forestry for the year ended 31st March, 1945.** Govt. Printer, Wellington. 1945. pp. 35. [1523].

05.3 (94). AUSTRALIA. **Annual report of the Commonwealth Forestry Bureau for year 1944.** Govt. Printer, Canberra. 1944. pp. 15. [1524].

05.3 (94) : 07.2. AUSTRALIA. **Council for Scientific and Industrial Research, Division of Forest Products: annual report for the year 1944–45.** Forest Products Laboratory, 69–77 Yarra Bank Road, South Melbourne. 1945. pp. 43. [1525].

05.3 (941). WESTERN AUSTRALIA. **Report on the operations of the Forests Department for year ended 30th June, 1945.** Govt. Printer, Perth. 1945. pp. 14. [1526].

05.3 (942). SOUTH AUSTRALIA. **Annual report on the operations of the Woods and Forests Department for the year 1943–1944.** Govt. Printer, Adelaide. 1945. pp. 13. [1527].

05.3 (946). TASMANIA. **Report of the Forestry Department for the year ended 30th June, 1945.** Govt. Printer, Hobart. 1945. pp. 11. [1528].

05.3 (97) : 07.2. **Colonial research 1944–45. I. Colonial Research Committee. Second Annual Report. II. Colonial Products Research Council. Second Annual Report. III. Colonial Social Science Research Council. First Annual Report.** H.M. Stationery Office, London. *Cmd.* 6663, 1945. pp. 31. [1529].

07. RESEARCH. ARBORETA. EXPERIMENTAL FORESTS

07.2 (485). Utvidgad skogsforskning. **[Expanded forestry research.]** *Skogen* 32, 1945 (339–40). [Sw.] [1530].

In 1944 the central State forestry research organization for Sweden changed its title from *Statens Skogsförsöksanstalt* to *Statens Skogsforskningsinstitut* [The State Forestry Research Institute] and, with some further modifications in 1945, its activities were re-organized and extended on the lines of a commission report of 1936. The new organization is still directed by a joint board, now increased by 3 members, which is also responsible for the *Skogshögskola* [State Forestry School]. The new sections and their commitments are: (i) Forestry Section, dealing with silviculture, mensuration and forest technology. The last-named is at present represented by two officers working on the rationalization of work and is intended to expand later into a special section. An officer of the Forestry Section handles forest products research in collaboration with *Svenska Träforskningsinstitutet* [The Swedish Wood-Research Institute]. (ii) Section of Botany and Soil Science, concerned with geobotany, soil biology, mycology (forest and timber fungi), plant physiology, and genetics. The Institute is asking in its 1946–47 estimates for funds to establish a separate section for genetics. (iii) Section of Zoology. (iv) Section of Statistics, responsible for investigating forest resources, drain on the forests, etc. This section is the former *Riksskogstaxeringen* [State Forest Survey].

Special emphasis is given in the present article to the need for expansion in the fields of technology (rationalization) and forest genetics. [Cf. *For. Abstr.* 6 (4).]

07.2 (97). **Colonial research 1944–45. I. Colonial Research Committee: Second Annual Report. II. Colonial Products Research Council. Second Annual Report. III. Colonial Social Science Research Council. First Annual Report.** H.M. Stationery Office, London, *Cmd.* 6663, 1945. pp. 31. [1531].

The Colonial Research Committee received and considered a full report on Agriculture, Animal Health and Forestry Research by an *ad hoc* sub-committee of the Colonial Advisory Council of Agriculture, Animal Health and Forestry. It is recommended that a separate Committee of specialists be appointed to advise on research in these fields, that in the Colonies themselves research should be organized on a regional rather than territorial basis, and that there be set up a separate Research Service. It is particularly hoped that under these new arrangements it will be possible greatly to expand forestry research work, which in tropical conditions is much more intimately related to general agricultural problems than is the case in more temperate zones. (p. 6).

07.5. Le Sueur, A. D. C. **Arboreta and forest gardens.** *Quart. J. For.* 40, 1946 (21–3). [1532].

The writer urges the advantages of planting specimen trees in groups rather than by ones or twos, with wide rides between the various species. He suggests that owners of arboreta should be permitted to dedicate them in the same way as forest land is dedicated, so as to secure continuity of management.

07.5 (42.1–8) : 23.23.11 : 24.5. Dallimore, W. **The National Pinetum, Bedgebury, Kent, 1925–1945.** *Quart. J. For.* 40, 1946 (5–20). [1533].

An account of the new National Pinetum at Bedgebury, Kent, which has been established just over 20 years. Notes are given on how the various genera are doing. A good deal of natural regeneration goes on at Bedgebury and notes are given on the natural seedlings of a number of species. Seeds taken from an 11-year-old Scots Pine were tested for germination and resulted in 85 per cent. seedlings. Experience shows that autumn planting is more successful than winter or spring planting, and obviates the necessity of watering. It was necessary to prune the Larches, which were widely spaced and therefore branched low down. It was decided to clear the lower parts of the trunks and gradually take the lower branches to a height of 10 or 12 ft. As all the branches were alive and vigorous, cleaning was done gradually at the rate of 12 in. a year, the work being done in summer. No tree suffered, by autumn a fine margin of callus was forming, all wounds healed quickly and the trunks are now normal. Similar work was carried out on several species of Pines and a few other genera.

09.1. *Forest History*

09.1 (44) : 12.19 : 60.3. François, L. La forêt domaniale de Darney-Martinville. **[The State forest of Darney-Martinville.]** *Rev. Eaux For.* 83, 1945 (1–15, 65–80, 127–37). [F.] [1534].

The State forest of Darney-Martinville, in the south-west of the department of the Vosges, covers an area of 5,290 ha. and forms part of a wooded area about twice that size. Until the Revolution it was managed as coppice with standards and provided fuel for the glass factories of the neighbourhood, but after 1827 it was, like all the forests of Lorraine, gradually converted into high forest. The first part of this article gives the history of the forest and its management; the second describes the topography, climate and soil; and the third the vegetation. The species composing the forest are 57 per cent. Beech, 32 per cent. Oak, 8 per cent. Hornbeam and 3 per cent. conifers (mostly *Pinus sylvestris*). An account is given of the management of the three types (Oak, Beech, Oak/Beech) which make up most of the area. The method adopted for the Beech type is a single periodic block on a rotation of 140 years; regeneration fellings should be light, progressive and repeated. In the Oak and Oak/Beech types, only the Oak is reckoned with, the secondary species (Beech, Hornbeam, etc.) not entering into the calculation of possibility, since it is necessary to protect the Oak. A maximum possibility has been calculated, on a very conservative basis, which may not be reached in any given year but must never be exceeded. The secondary species in regeneration areas are felled only when sowings are to be made, or in mast years. Oak regeneration is subject to liberation operations every 2 or 4 years. When any considerable area is seeded, it is possible to pass directly from the seeding felling to the final felling, which takes place when the regeneration has attained a height of 75 cm.

09.1 (494) : 81. NAGEL, J.-L. Le service forestier vaudois de 1798 à 1806. **[The forest service in the Canton de Vaud from 1798 to 1806.]** *J. for. suisse* 95, 1944 (255–61); 96, 1945 (59–72). [F.] [1535].

The writer, having come into possession of the papers of his great-grandfather, who was Inspector of Forests for the Canton de Vaud from 1798 to 1806, gives an account of the organization of the forest service, the state of the forests, the system of management and an estimate of the growing stock and yield at that date.

09.2. *Pre-history*

09.2 (47.2). SOLONEVICH, K. I. O pȳl'tsevom issledovanii Tolpolovskogo pozdnelednikogo profilya. **[On the pollen analysis of a post-glacial profile at Tolpolovo.]** *Sovetsk. Bot.* 13 (2), 1945 (38–45). [Russ.] O.B.D. [1536].

Results of pollen analysis of the post-glacial profile of the Tolpolovo peat bog, the only known place in the Leningrad region where, under a complete series of peat deposits lie post-glacial sediments with a genuine arctic flora. (i) In the first half of the first period a large area was covered by tundra vegetation with *Salix* and *Betula nana*. Forests were so distant that not even transported pollen of Pine is recorded. The second half shows a temporary approach of forest; a considerable amount of Pine and Birch (*B. alba* sensu lato) pollen is recorded, but the actual site was still tundra. (ii) At the end of the tundra period sporadic Birch (*B. alba*) and Spruce appeared (Spruce/Birch forest tundra), (iii) The forest tundra gradually changed to Pine/*B. alba* forest of the northern type, with an admixture of Spruce; *B. nana* still remained over wide areas. (iv) In the following phase *B. nana* and Spruce disappeared, Pine became rarer and *B. alba* forests predominated. (v) Finally, in the boreal period, Alder appeared in considerable quantity with *Ulmus* and *Corylus*; Pine also increased but Birch still predominated.

References are given to papers on the development of the forests.

09.2 (54) : 12.26–8. PURI, G. S. **Lombardy Poplar (*Populus nigra* Linn. var. *fastigiata* Desf.) in India.** *Indian For.* 71, 1945 (423–5 + plate). [1537].

The author endeavours to show that the Lombardy Poplar, the pyramidal variety of *Populus nigra* Linn., which is commonly planted in Kashmir and north-west India and is believed to have been introduced from Asia, is probably indigenous to India and that its existence in Kashmir perhaps dates from early Pleistocene times. The palaeobotanical evidence is based on the discovery in the Karewa deposits of Kashmir of a few well defined leaf impressions which are identical with modern leaves of the Lombardy Poplar.

09.2 (72 : 728 : 729 : 8). DARRAH, W. C. **Paleobotanical work in Latin America.** In *Plants and Plant Science in Latin America.* Chronica Botanica Company, Waltham, Mass. 1945. pp. 181–3. [Botanical Museum, Harvard Univ.] O.B.D. [1538].

A review of known records of palaeobotanical discoveries in Latin America and of the distribution of fossil plants and silicified woods. Plant fossils from the Devonian period onwards have been found in scattered parts of Latin America from Mexico to Tierra del Fuego.

09.4. *Forest Statistics*

09.4 (47.4). MOROZOV, A. V. Lesa i lesnaya promȳshlennost' Latvii, Estonii i Litvȳ. **[The forests and forest industry of Latvia, Estonia, and Lithuania.]** *Lesnaya Ind.* No. 10/11, 1940 (28–31). [Russ.] [1539].

Forest products played a large part in the economy of the Baltic States, and exports of timber products, mainly to Britain, were considerable. Good waterways made it possible to float the timber down to the seaports. Each State had a great number of sawmills and wood-working industries, but production in the latter was limited by the lack of raw materials. The following data are characteristic of normal conditions:—*Latvia*: of the total forest area of 1·8 million ha., 1,383,698 ha. were State forest, composed of Pine 52·4 per cent., Spruce 24·5 per cent., Birch 15 per cent., Poplar and Aspen 3·9 per cent., Common Alder 3·3 per cent., Grey Alder 0·6 per cent., Oak, Ash, and other species 0·3 per cent. Most of the forests are young. Annual increment, in cu.m. per ha., in the State forests was Pine 2·3, Spruce 4·3, Birch 4·3, Aspen 4·2. The total annual increment in State forests was about 4 million, and the growing stock about 140 million cu.m. Private forests had an annual increment of about 5 million cu.m. Fellings for 1937–38 were 5,814,044 cu.m. consisting of 3,439,256 timber; 2,188,076 fuelwood; 147,982 branches, brushwood, fascines; 38,730 stumpwood.

Estonia: The total forest area is 931,000 ha. of which 717,000 ha. belonged to the State, and the rest to peasants and other private owners. The composition by species is Pine 41 per cent., Spruce 29·2 per cent., Birch 24·6 per cent., Aspen 2·1 per cent., Alder 2·2 per cent., and other broadleaved species 0·1 per cent. Most of the forests are young. The total annual increment is 3·3 million cu.m. of which 2,150,000 is produced in the State forests. To this should be added the annual increment of shrubs (furnishing brushwood) of about 1·5 million cu.m. Fellings, including brushwood and stumps, averaged 4 million cu.m. Fellings in the State forests for 1938–39 were 2,224,700 cu.m. consisting of 1,181,800 timber, 1,034,500 fuelwood and brushwood, 8,400 stumpwood.

Lithuania: The total forest area is 1,204,283 ha., of which 1,039,463 were owned by the State and 164,820 by private owners. The percentage composition by species is Pine 41 per cent., Spruce 32 per cent., Birch 11 per cent., Aspen and other soft-wooded species 6 per cent., Alder 8 per cent., Oak 1 per cent., Ash and other hard-wooded species 1 per cent. The total annual increment is 3,854,000 and the growing stock 139,486,000 cu.m. Most of the forests are young. Annual fellings exceeded increment.

09.4(489):46. SABROE, A. S. Tyskernes Hugster og Skader i de jydske Skove og Plantager. En foreløbig Redegørelse. **[Fellings and damage by the Germans in the forests and plantations of Jutland. A preliminary account.]** *Dansk Skovforen. Tidsskr.* 31, 1946 (1–17). [Dan.] [1540].

Notes on major depredations known to the author. Being nearest to the fortified positions on the west coast, the heath forests suffered the most damage, the seriousness of which is aggravated by the fact that this is the most poorly stocked region of Denmark and that the younger plantations have been deprived of shelter by the removal of the older trees. Other forests at present appear to have come through the occupation with less damage than might have been expected.

09.7. *Monographs of Individual Forest Regions*

09.7 (410) : 09.1 : 6 : 2 : 9 : 23.3. TAYLOR, W. L. **Forests and forestry in Great Britain.** Crosby Lockwood & Son, Ltd., 20 Tudor Street, London, E.C.4. 1945. pp. x + 172 + plates. [1541].

Not a textbook but an outline of forest history and forestry in Great Britain, designed to spread interest in British woodlands and the means by which forests are raised and conserved and to give an idea of the value of forestry to the future welfare of the people. It deals with the origin of the flora; destruction, enclosures and early attempts at re-stocking; an outline of management, silviculture and policy; the land and soil suitable for forests; forest making and mending; the principles of perpetual profit; forest products; the effect of war on the woods; social and aesthetic values; natural history, the forest community, pests and perils (with a chapter on fire); forestry as a career, the curricula and costs of degree courses; service conditions and scales of pay; forestry and the nation; the timber famine.

09.7 (44) : 21 : 12.26–8 : 23.3 : 35. GALZIN. La production forestière de l'Aigoual. **[The forest production of the Aigoual.]** *Rev. Eaux For.* 83, 1945 (317–42). [F.] [1542].

The forests of Aigoual, on the borders of the departments of Gard, Lozère and Aveyron, have a very variable climate, being subject to Mediterranean, Atlantic and Continental influences. This climate, which may be very dry in open ground and very damp in a forest, necessitates the use of temporary species in afforestation. The climate, soil and aspect of the region are analysed in some detail and silvicultural conclusions drawn from the data. A second chapter deals with the Beech woods of the region, and the occurrence of Beech in considerable quantities in the coniferous woods. This species regenerates easily, is not much exploited, is more drought-resistant than Fir, more tolerant than Spruce, and more wind-resistant than either, and will probably become the dominant species when the transitory species have disappeared. The existence of these Beech woods, which already cover a large area and are increasing at the expense of both pasture and coniferous forest, presents a difficult problem, that of the utilization of 12,000 to 15,000 cu. m. of Beech per annum, without which the region will gradually become an immense unproductive forest. The lack of an adequate network of roads, the unsuitability of the trees for sawtimber, the lack of organization and man-power in the charcoal industry, combine to discourage the use of this potential supply of wood. The writer believes that the only practicable outlet for this production is a greatly increased use of producer-gas-driven lorries.

09.7 (44) : 57. GALZIN. Le Ventoux et l'Aigoual. **[The Ventoux and the Aigoual.]** *Rev. Eaux For.* 83, 1945 (596–604). [F.] [1543].

The writer compares the climate, soil, and productivity of the forests of Le Ventoux with those of Aigoual [see preceding abstract] on the other side of the Rhone.

09.7 (46). DELMAS. Les forêts d'Andorre. **[The forests of Andorra.]** *Rev. Eaux For.* 83, 1945 (565–92 + plates). [F.] [1544].

A detailed account of the forests of Andorra, based on a survey made by the French Government in 1941. Much of the forest now consists of Birch, as a result of over-exploitation of the communal forests in which all villages have a right to cut wood for their own use, but there are also some areas managed on a rough selection system for the production of large timber. Scots Pine and Mountain Pine [*Pinus montana* var. *uncinata*] are the species most valued by the local sawmills, which mostly export their products to Spain.

09.7 (494). EISELIN, V. Die forstlichen Verhältnisse des Kantons Tessin. **[Forest conditions in the Canton of Ticino.]** *Schweiz. Z. Forstw.* 96, 1945 (239–49). [G.] [1545].

Ticino has a forest area, including unproductive forest land, of 82,000 ha., of which 64,000 is public (chiefly communal) forest and 18,000 in private ownership. Productive forest is estimated at 51,000, forest pasture at 17,000, and unproductive forest land at 13,000 ha. High forest, including Chestnut groves, accounts for some 29,000, coppice for about 28,000, and coppice with standards for 1,000 ha.

Details are given of the climate, which is oceanic and Mediterranean in type and characterized by heavy, concentrated precipitation with a large number of fine days.

A line through Jorispass and Tamaro divides the Canton geologically into two major regions: (*a*) a northern with gneisses and metamorphosed limestones; and (*b*) a southern with unmetamorphosed dolomites and limestones.

There are 6 Forest Divisions with a total of 32 Districts, the latter under the charge of lower-grade foresters, who are State-appointed but to whose salaries all important bodies concerned with forestry, besides the State, contribute.

The chief zones are: (i) The Chestnut region, between 200 and 900 m., with many Chestnut groves having a total area of about 8,800 ha. These are important both for their nut crops and for timber, large quantities of which are used for tanstuff; there are also large areas of Chestnut coppice, which furnish firewood, leaf litter, and poles for agricultural use, besides tanwood from larger dimensions. Some pure Oak and Oak/Chestnut stands exist, but no Oak high forest. In Sottoceneri more southerly species occur, e.g. *Ostrya*, *Celtis*, *Diospyros lotus*, *Fraxinus ornus*, etc. (ii) The montane region, from 900 to 1,500 m., is dominated by Beech, with some Birch, almost all managed as coppice-selection forest and giving very good yields. (iii) The subalpine region, up to 1,900 m., is dominated by

Spruce, with some Silver Fir and Larch, and local Scots, Cembran and Mountain Pine.

Among notes on forest fires, it is stated that these are more frequent in hardwoods, owing to the presence of much dry ground cover, than in coniferous stands, which have moister soils with little or no ground vegetation. Fire-damaged stands are cut rapidly to promote coppicing. Chestnut and Oak are relatively resistant and Beech very sensitive to fire. Goat grazing causes serious damage and needs regulation, particularly as it is the richer people who own most goats and so benefit at the general expense.

The history of Canton forest laws is briefly described and some details are given of afforestation and protective works. The latter cost 4,895,000 Fr. for the period 1872–1923 and 5,915,000 Fr. for 1924–43.

The normal annual cut is about 110,000 cu.m. The peak for the first World War was 147,000 cu.m. in 1918, but for 1940–45 the annual average was 212,000 cu.m., which represents a rise of 100 for public and 50 per cent. for private forests. The cut has generally been higher for the latter as they are mostly situated on the lower and better land and are less damaged by grazing. Overcutting has occurred chiefly in the coppice forests.

09.7 (54.9). VAHID, S. A. **Forests of Hyderabad-Deccan.** Osmania University Extension Lecture. 1944. pp. 13 + plates + map. [Inspector-General of Forests, Hyderabad-Deccan.] [1546].

The State forests of Hyderabad occupy an area of 9,357 sq. miles, or about 11·3 per cent. of the total area of the Dominions. This amount is insufficient in itself and badly distributed, nine-tenths of it being in the eastern part of the State. As a result of over-grazing, lack of tending and lack of protection, the forests are in a poor condition and are not regenerating.

The forests may be divided into the following three main divisions: (1) In the Godavari Valley where two distinct types are found: (A) the mixed Teak type on well drained slopes with rich, deep loam; and (B) mixed Teak in plain forests on alluvial and dry shallow soils. Type (A) consists of a good growth of Teak 50–70 ft. high and 3–5 ft. girth at breast height; associated with the Teak are *Terminalia tomentosa, Hardwickia binata, Pterocarpus marsupium, Diospyros melanoxylon,* etc., and *Dendrocalamus strictus* is common throughout. Type (B) consists of an open crop of miscellaneous species with the proportion of Teak varying from 0 to 25 per cent. with an average height of 25 ft. Bamboos are absent from this type and the undergrowth consists of grasses.

(2) Forests of the Krishna Basin consist mainly of Type (C) in which *Hardwickia binata* is the main species, associated with *Anogeissus latifolia, Diospyros melanoxylon, Terminalia tomentosa* and others.

(3) Forests in the north-west of the Dominions consist largely of a special type with *Santalum album* as the dominant species.

As a result of neglect and maltreatment in the past, the timber is mostly of an inferior type.

09.7 (72 : 728 : 8) : 90. BEVAN, A. **Forestry in Latin America and its future.** In *Plants and Plant Science in Latin America.* Chronica Botanica Company, Waltham, Mass. 1945. pp. 174–6. [U.S. Forest Service, Washington, D.C.] O.B.D. [1547].

According to the best information obtainable, 40 per cent., or 3,325,000 sq. miles, of the area known as Latin America is under forest. Most of the forests lie within the tropics. At present, lands which adjoin centres of population, or which can be reached by fairly good roads, by railroads, or by water, are almost invariably denuded of forest cover, whereas hundreds of thousands of acres of forest have not yet been penetrated or utilized. Although many of the Latin American countries have forest laws restricting cuttings, there is in general little or no administration or management of these forests except in the British Colonies where, owing to lack of sufficient funds for research, trial and error has usually been the method employed.

One of the most immediate needs for both utilization and management is a survey to determine the extent and composition of the forests, and a start was made in 1943 by a project sponsored by the Co-ordinator of Inter-American Affairs and carried out by the U.S. Forest Service to make a study of the forest resources of Costa Rica and Ecuador and the uses to which they are best adapted. The project was, however, discontinued in June of the same year.

In addition to a survey of the extent of forest, a determination should be made of all species which occur in commercial quantities, as a means of establishing their proper utilization; and in areas of heavy population, consideration should be given to comprehensive forestry programmes to restore forest growth on submarginal denuded lands, thus providing firewood, charcoal, posts and poles, and helping to check erosion and to restore these lands to a useful economy. For this purpose quick-growing, easily coppiced species, such as *Jambosa jambos*, are preferable to slow-growing, high-value timber trees.

One of the greatest needs for the future of forestry in tropical America is the means of training men (particularly the citizens of the countries in which the forests occur) in tropical forestry. The establishment of a school or schools for training tropical foresters is strongly advocated.

A table is included showing the population, total area, forest area, and percentage of forested land, in the Latin American countries.

09.7 (728.4). Sέveren, M. L. van. Recursos naturales del reino végetal de El Salvador. **[Plant resources of El Salvador.]** In *Plants and Plant Science in Latin America.* Chronica Botanica Company, Waltham, Mass. 1945. pp. 57–60. [Span.] [Ministerio de Agricultura, San Salvador.] O.B.D. [1548].

Except for a few forests which have been conserved, practically the whole of El Salvador is under cultivation. The most important agricultural product (representing 80 per cent. of the country's exports) is coffee. Next in importance is sugar cane. Balsam (*Myroxylon balsamum*) is grown only on one strip of coast known as 'Costa del Bálsamo'. At one time the cultivation of this tree was a profitable venture, but in recent years the export of Balsam has been very small and exploitation has been limited to wild trees. Leguminous species, particularly *Inga*, are important as shade trees in the coffee plantations and in regulating water supplies. The ill effects of forest removal are to be seen in the drying up of sources of water and in the decreased volume of water in small streams. Laws have been passed forbidding the cutting of trees in the vicinity of water-supply areas without special permission and requiring replacement of cut trees. The planting of useful timber trees (for construction and furniture) is officially encouraged.

09.7 (728.5) : 12.25–9 : 34 : 31.0. Ashton, J. **On the plant resources and flora of Nicaragua.** In *Plants and Plant Science in Latin America.* Chronica Botanica Company, Waltham, Mass. 1945. pp. 60–4. [Texas Agricultural College, College Station, Texas.] O.B.D. [1549].

The chief money crop of Nicaragua is coffee, but the country also produces considerable quantities of hardwoods, dyewoods, and timber suitable for constructional purposes. Among the important and valuable timbers which grow in great abundance and luxuriance in many parts of the country (but more especially on the Atlantic slope) are Mahogany, Cedar, Pochote, Rosewood, Quebracho, Laurel and *Guaiacum.* Trees valuable for their fruits include Aguacate (*Persea americana*), Mango (*Mangifera indica*), Marañon (*Anacardium occidentale*), Papaya (*Carica papaya*), and Nispero (*Achras sapota*).

09.7 (729.1) : 34. Roig, J. T., and Acuña, J. **Plant resources of Cuba.** In *Plant and Plant Science of Latin America.* Chronica Botanica Company, Waltham, Mass. 1945. pp. 70–3. [Estacíon Experimental Agronómica, Santiago de Las Vegas, Cuba.] O.B.D. [1550].

The principal plant products of Cuba are sugar cane and tobacco. When discovered, the island was covered with dense forests containing many valuable timbers suitable for constructional work, carpentry, and cabinet work, but, owing to excessive exploitation, high forest, low forest and Mangrove swamps now occupy only 16 per cent. of its total area. A number of woods are utilized in rural construction and for railway sleepers, telegraph poles, and fence posts. Only a few, such as Mahogany, Spanish or Cigar-box Cedar, Dagame, Lignum Vitae, and Sabicú, are exported, but the value of the forest products marketed is nevertheless still considerable. Several laws and decrees have been promulgated for the reforestation of Cuba, and the Government maintains nurseries for the free distribution of valuable forest plants and seeds of both native (e.g. Mahogany, Spanish Cedar) and exotic (e.g. Teak, Eucalypts, Honduras Mahogany) tree species.

09.7 (729.3 : 729.4) : 12.25–9 : 34. Barker, H. D. **Plant resources of Hispaniola.** In *Plants and Plant Science in Latin America.* Chronica Botanica Company, Waltham, Mass. 1945. pp. 78–81. [U.S. Department of Agriculture, Washington, D.C.] O.B.D. [1551].

The western part of Hispaniola is more densely populated and more intensively cultivated than the eastern portion of the island, which is much richer in forest resources and in grazing plants. The author lists the main economic and potentially economic plants under families. Among the important timber species are trees of the following families: Pinaceae, Juglandaceae, Ulmaceae, Moraceae, Annonaceae, Lauraceae, Fabaceae, Zygophyllaceae, Rutaceae, Meliaceae, Euphorbiaceae, Sapindaceae, Rhamnaceae, Bombacaceae, Sterculiaceae, Rhizophoraceae, Combretaceae, Sapotaceae and Bignoniaceae. Many other trees of potential economic importance are also mentioned.

09.7 (729.5) : 12.19 : 97.1. HORN, C. L. **Plant resources of Puerto Rico.** In *Plants and Plant Science in Latin America.* Chronica Botanica Company, Waltham, Mass. 1945. pp. 83–5. [U.S. Office of Foreign Agricultural Relations, Washington, D.C.] O.B.D. [1552].

Factors affecting the vegetation of Puerto Rico include elevation, rainfall and soils. Vegetation ranges from tropical rain forests to xerophytic communities, and the soils are in general not very fertile. Many of the plants of Puerto Rico are restricted endemics; *Magnolia splendens*, *M. portoricensis* and *Stahlia monosperma* are valuable timber trees. In 1939, 60,162 ha. were under woodland. Of these approximately 11,797 ha. are administered by the United States Forest Service, while approximately 19,665 ha., including the Mangrove swamps, are administered by the Insular Forest Service. The Mangrove forests provide the principal source of charcoal, the common domestic fuel of the island; much of the Coffee-shade thinnings is also converted into charcoal. Important forest tree species are *Cedrela odorata*, *Dacryodes excelsa*, *Xanthoxylum flavum*, *Guaiacum officinale*, *Magnolia splendens*, *M. portoricensis*, *Montezuma speciosissima*, *Bucida buceras*, *Manilkara nitida*, *Tabebuia pallida*, *Stahlia monosperma*, *Ocotea moschata*, *Hymenaea courbaril*, *Andira inermis*, *Jambosa jambos*, and *Euterpe globosa*.

09.7 (81). DOMINGUES, A. Agricultura no Brasil. **[Agriculture in Brazil.]** In *Plants and Plant Science in Latin America.* Chronica Botanica Company, Waltham, Mass. 1945. pp. 108–11. [Port.] [Brazilian Embassy, Washington, D.C.] O.B.D. [1553].

Eight phytogeographical regions are recognized and briefly discussed: (1) tropical forests; (2) Pine forests; (3) thickets (*cerrados*); (4) the plains; (5) the '*caatingas*'; (6) the Babaçú Palm forests; (7) littoral vegetation; and (8) marshes. The chief plant products of Brazil are listed. They include oil seeds (*Oiticica*, etc.) and rubber (*Hevea brasiliensis*).

09.7 (82) : 34.2 : 23 : 9 : 81. TORTORELLI, L. A. Los bosques argentinos y sus industrias derivadas. **[The Argentine forests and their derived industries.]** In *Plants and Plant Science in Latin America.* Chronica Botanica Company, Waltham, Mass. 1945. pp. 135–40. [Span.] [Dirección Forestal, Ministeria de Agricultura, Buenos Aires, Argentina.] O.B.D. [1554].

Although *Schinopsis balansae* and to some extent *Schinopsis lorentzii* and *Prosopis* spp., have been exported from Argentina since the end of the nineteenth century, exports of timber are generally limited, while certain forest products, such as veneers, wood pulp, and wood cellulose, are imported on a considerable scale. The author gives a brief review of forest legislation in Argentina and the organization of the Forest Service. There is at present no Forest Law in Argentina, and provincial legislation pertaining to forestry is rather primitive, but efforts are being made to organize forestry under the newly created Forest Service (Dirección Forestal) of the Ministry of Agriculture. The Dirección Forestal is composed of three main sections; (1) silviculture; (2) wood technology; and (3) forest administration.

As in other parts of South America, there has been in Argentina progressive and rapid deforestation, and plans are being made for re-afforestation. Among the species expected to do well, without irrigation, in poor regions such as the Bosque pampeano are *Pinus halepensis*, *P. pinea*, *P. pinaster*, *Cupressus arizonica*, *C. sempervirens*, various *Eucalyptus* species, and the native *Prosopis alba*. In regions where forests of some kind have remained in spite of the widespread devastation (as in the sub-antarctic region) reforestation presents no difficulty. Such forests can usually be regenerated by the planting of conifers (e.g. *Pinus sylvestris*). In the delta of the River Paraná, which is the one region in which silviculture has been practised to any great extent so far, there are widespread plantings of *Populus nigra* var. *italica*, *Salix alba* var. *caerulea*, and the disease-resistant hybrid Italian Poplar A.M. (*Populus nigra* var. *stella* × *P. canadensis*). There are also important plantations of *Taxodium distichum* and *Pinus radiata*. Other species suitable for use in afforestation in the delta region and in the vicinity of the Federal capital are *Quercus pedunculata*, *Fraxinus excelsior*, *Quercus palustris*, *Grevillea robusta*, *Ulmus campestris*, *Platanus orientalis*, *Robinia pseudoacacia*, *Ailanthus glandulosa*, *Liriodendron tulipifera*, *Melia azedarach*, *Araucaria bidwillii*, *Pinus taeda*, *P. echinata* and *P. caribaea*.

In the sub-antarctic forests *Larix europaea* [*decidua*], *Betula alba* [?] and *B. verrucosa* grow well; while in the subtropical Tucuman-Bolivian region *Swietenia mahagoni* and *Tectona grandis* are among the most promising species. Important indigenous species used for re-afforestation include *Araucaria angustifolia*, *Piptadenia macrocarpa*, *Torresia cearensis*, *Cedrela lilloi*, *Enterolobium contortisiliquum*, *Jacaranda acutifolia*, *Pterogyne nitens* and *Tabebuia ipe*.

Afforestation of the treeless pampas is also recommended. Species suitable for this purpose include *Gleditsia triacanthus*, *Robinia pseudoacacia*, *Eucalyptus* spp., and *Casuarina cunninghamiana*.

The extraction of tannin and the manufacture of charcoal are two important Argentine industries. The species from which tannin is extracted are *Schinopsis balansae*, *S. lorentzii* and *Astronium balansae*. The species most commonly used in charcoal manufacture are *Aspidosperma quebracho-blanco*, *Prosopis nigra*, *P. alba*, *P. algarrobilla* var. *ñanduboy*, *Schinopsis lorentzii*, *Zizyphus mistol*, *Gourliea spinosa*, *Tabebuia nodosa* and *Cercidium praecox*. The first two species are used alone, while the others are used in mixture. Various less important industries connected with forestry are listed.

09.7 (82) : 12.19 : 23.3. SKOTTSBERG, C. **The Falkland Islands.** In *Plants and Plant Science in Latin America*. Chronica Botanica Company, Waltham, Mass. 1945. pp. 315–8. [Botaniska Trädgården, Göteborg, Sweden.] O.B.D. [1555].

Although the Falkland Islands are essentially treeless, experiments have shown that *Nothofagus betuloides*, *Pinus sylvestris*, and *P. nigra* will grow there if effectively sheltered from the wind, either by a wall or by sufficiently high hills. The author suggests that it may be possible to create small forests of *Pilgerodendron uviferum* (*Libocedrus tetragona*), *Nothofagus antarctica*, *Drimys winteri*, *Maytenus magellanica*, or species of *Pinus*, *Betula* and *Sorbus* in some of the valleys.

09.7 (85). HODGE, W. H. **Plant resources of Peru.** In *Plants and Plant Science in Latin America*. Chronica Botanica Company, Waltham, Mass. 1945. pp. 119–21. [Embassy of the U.S.A., Lima, Peru.] O.B.D. [1556].

The three main physiographic zones of Peru are: (1) *La Costa*; (2) *La Sierra*; and (3) *La Montaña*. The plant resources of each zone are briefly discussed. The montaña includes all the eastern forested regions. For the most part this zone is very moist and is covered by evergreen forests which extend west from the tropical lowlands of the Amazon basin to the eastern slopes of the Andean ranges up to elevations of about 3,000 m. In northern Peru, irregular patches of temperate montaña forest are found on the Pacific slopes of the Andes in the departments of Piura, Lambayeque, and Cajamarca. Transport costs have so far prohibited the development of agricultural resources in the montaña on any large scale.

The forested areas of Peru are divided into two zones: (1) the *ceja de la montaña*, which includes the fringes of low-statured *montaña* forests bordering on the cool sierra; and (2) the *montaña*, composed chiefly of tall, tropical rain forests. Two important medicinal plants, Cascarilla (*Cinchona* sp.) and Coca (*Erythroxylon coca*) occur in the mountainous *ceja de la montaña*. The lowland montaña areas contain many hardwood timbers of potential importance. Mahogany, Cedar and Balsa are among the timbers exported from the department of Loreto. Wild rubber (*Hevea brasiliensis*), chiclé and balatá are produced in small quantities in the departments of Loreto and Madre de Dios. Investigations are now in progress for the initiation of a plantation rubber programme. There is as yet no Forest Service in Peru, and no forest or soil conservation programme is at present in operation.

09.7 (86). LINDSAY, W. R. **Plant resources of the Panamas.** In *Plants and Plant Science in Latin America*. Chronica Botanica Company, Waltham, Mass. 1945. pp. 67–8. [Canal Zone Experiment Station, Summit, Panama.] O.B.D. [1557].

Cattle raising for beef is the principal branch of agriculture in Panama and by far the greatest source of revenue. There are, however, extensive forests on the slopes of the mountains and numerous banana plantations along the Atlantic coast. Over fifty species of commercially valuable timber trees are found, including Mahogany, Cocobolo [*Dalbergia retusa*] Guayacan [*Guiacum* sp.], and Nispero [*Mimusops* sp.]. Castilloa rubber trees are common in many provinces.

09.7 (88). STAHEL, G. **The natural resources of Surinam.** In *Plants and Plant Science in Latin America.* Chronica Botanica Company, Waltham, Mass. 1945. pp. 107–8. [Govt. Agricultural Exp. Sta., Paramaribo, Surinam.] O.B.D. [1558].

The interior of Surinam consists of uninterrupted rain forest, while savannas and extensive open marshes occupy the coastal region. The large local demand for timber for house building is met by exploitation of the immense natural forests, but, so far, the export of lumber has been limited to *Dicorynia paraënsis*, which is particularly useful for harbour work owing to its resistance to marine borers. Plantings of Para rubber have generally been a failure. After a period of very satisfactory growth up to 1915, the trees were attacked by the South American *Hevea* leaf disease. Further trials may be carried out with disease-resistant clones. In addition to lumber, the natural forests furnish balata rubber and Quassia bitter wood. The latter has, however, been entirely supplanted in recent years by the cheaper Jamaica bitter wood.

09.7 (88.1). GROVES, G. R. **The plant resources of British Guiana.** In *Plants and Plant Science in Latin America.* Chronica Botanica Company, Waltham, Mass. 1945. pp. 105–7. [Department of Agriculture, Georgetown, British Guiana.] O.B.D. [1559].

The colony may be divided into three belts: (1) the northern coastal strip of swampy marine alluvium which extends inland for 10 to 40 miles, the margin of which is protected from the sea and rivers by a dense growth of *Rhizophora mangle* and *Avicennia nitida*; (2) a broader and slightly elevated tract of chiefly undulating land composed of sandy and clayey soils and traversed in places by sand dunes; and (3) the more elevated portion of the colony to the south, the eastern part of which is almost entirely covered with forests.

The cultivation of *Hevea brasiliensis* has been tried. Yields are favourable, but owing to the overproduction of rubber in other parts of the world, rubber cultivation is not generally profitable. The natural forests of British Guiana cover 78,180 sq. miles, or about 87 per cent. of the total area of the colony. Only the more accessible forests are worked for timber, the main economic species being Crabwood, Mora, Greenheart and Wallaba. As all the buildings in the Colony are made of wood, the timber industry is extremely important. Of the timbers exported, Greenheart (*Nectandra* sp.) is in greatest demand. Other forest products include gums, oils and balata, of which a small amount is exported.

09.7 (89) : 34. CARABIA, J. P. Productos naturales y agricultura en el Paraguay. **[Natural products and agriculture in Paraguay.]** In *Plants and Plant Science in Latin America.* Chronica Botanica Company, Waltham, Mass. 1945. pp. 125–7. [Span.] [New York Botanical Garden, New York City.] O.B.D. [1560].

Paraguay may be divided into three major natural regions: (1) the Chaco region to the west of the River Paraguay; (2) the region east of that river; and (3) the region west of the Chaco, composed of an extensive tract of mainly sandy, low-lying land liable to flooding, covering two-thirds of the total area of the country.

The principal industry of Paraguay is cattle raising, followed in importance by various cultivated crops (particularly cotton) and forest products, including Quebracho and various constructional timbers. Quebracho owes its importance mainly to its large tannin content, but its timber is also useful for railway sleepers and for general constructional work. Various trees are known as 'Quebracho' in Paraguay, the most highly valued of these being Quebracho Macho (*Schinopsis balansae*), followed in importance by Quebracho Colorado (*Schinopsis lorentzii*). Quebracho Blanco (*Aspidosperma quebracho-blanco*), often confused with the true Quebracho, is exploited for the same purposes as the latter. Among the many valuable timbers of Paraguay are *Piptadenia communis*, *Astronium gracile*, *A. balansae*, *Banara bernardinensis*, *B. hassleri*, *Cedrela fissilis*, *Trichilia catigua* and *Prosopis juliflora*, all of which occur in the high mountainous region in the east of the country. Valuable woods of the Chaco region include *Bulnesia sarmientoi*, *Tecoma* spp., *Tabebuia* spp. and *Jacaranda* spp.

1. FUNDAMENTAL NATURAL LAWS OF THE FOREST

11.1. *Atmosphere*

11.12. Pressure and Movement of Air

11.12 : 91.3. WOELFLE, M. Bemerkungen zu 'Der Waldwind' von Horst-Günther Koch. **[Comments on 'The forest wind' by Horst-Günther Koch.]** *Forstw. Cbl. u. Thar. forstl. Jb.* No. 2, 1944 (131–6). [G.] [1561].

The existence of any 'forest wind' of the nature suggested by Koch [see *For. Abstr.* 4 (84)] is strongly disputed. It is held that Koch's own valuable data on temperature distribution, which extend and confirm those obtained by previous workers, show that such a wind would be a physical impossibility. The effect observed is quite possibly due to variation in local relief, as even small local features of relief may affect the flow of cool air. A sloping canopy might have the same effect, but in neither case could the resulting movement of air be termed a 'forest' wind in Koch's or any proper sense. Criticisms are made of other individual points in Koch's paper.

11.15. Light

11.15 : 11.16 : 12.11.23. HESS, E. Sonnenflecken und Baumwachstum. **[Sun spots and tree growth.** (With comment by Knuchel.)] *Schweiz. Z. Forstw.* 96, 1945 (182–3). [G.] [1562].

Waldmeier (*Sonne und Erde*, Zürich, 1945) is quoted as claiming that the influence of the 11-year cycle is evident in tree growth, annual rings formed at the sunspot maxima being 2–3 times as wide as those formed at minima. The correlation is said to be observable in *Sequoia gigantea* back to 1,000 B.C. and in German and Swedish Pine.

Knuchel's comment is that if such a correlation exists in Swiss trees it must be masked by other unexplained factors. The Director of the Central Swiss Meteorological Institute denies that correlation between the sunspot cycle and climate, as regards temperature, moisture, precipitation and hours of sunshine, has been demonstrated and doubts whether a correlation with plant growth exists.

11.4. *Soil*

11.4 (47.0) : 07.2. REMEZOV, N. P. O zadachakh laboratorii lesnogo pochvovedeniya VNIILKh. **[The tasks of the forest soil science laboratory of the All-Union Forestry Research Institute.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* No. 24, 1941 (5–18). [Russ.] [1563].

A broad review, with emphasis on the interaction of forest and soil, of the need for further studies, especially in the water-conserving zone. Knowledge of forest soils is still inferior to that of soils under agricultural use.

11.41. Soil Physics

11.41.3. SOZ̄YKIN, N. F. Kontaktny̅ metod opredeleniya vlazhnosti pochv i gruntov. **[The contact method of determining soil and subsoil moisture.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* No. 24, 1941 (193–246). [Russ.] [1564].

A distinction is drawn between the electrical resistance of the soil along the path of a current between two electrodes and that at the point of contact between electrodes and soil. The latter is termed contact resistance. This cannot be measured directly, but extensive field and laboratory experiments showed that, in general, the resistance measured by means of metal electrodes, in the moisture range up to field capacity and with fairly close spacing, is primarily contact resistance, and is dependent upon the area of the electrode, there being a practically rectilinear relationship, for a given resistance, between moisture content of the soil and area of electrode. Only in the upper horizons of podzolized soil in a dry condition or with very wide spacing of electrodes, does resistance in the soil itself attain any considerable magnitude under field conditions; otherwise it is low and has little effect on moisture content calculated by taking the observed resistance to be the same as contact resistance. Current is conducted by the soil solution, and contact resistance is conditioned by the area of contact between electrodes and the soil solution, either as a film around particles or when filling the capillaries. Moisture is the principal factor and concentration of soil solution a secondary distorting factor, thus if the content of salts is constant, resistance varies almost exclusively with the former. A formula that has proved applicable in numerous trials to the calculation of moisture from resistance is $W = \frac{a}{R^b} + C$, where W = moisture per cent.; R = resistance; C is a constant related to hygroscopicity and approaching the value for 'bound' water; a is a parameter depending upon area of electrodes, conductivity of soil solution and unit of resistance measurement, and b is connected with texture and salt status of the soil. For further accuracy a correction for temperature may be introduced.

Several series of tests in 1938–40, using stationary installations and specially designed electrosondes, showed that soil moisture can be determined by this method to an accuracy of 10 per cent. or less based on the true value. This method is suitable for continuous observations, subject to periodical checking by the weighing method and other laboratory controls.

11.41.3 : 11.62. Sozȳkin, N. F. Opredelenie vodopronitsaemosti i vlagoemkosti lesnykh pochv. [**Determination of the permeability to water and the moisture capacity of forest soils.**] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* No. 24, 1941 (161–92). [Russ.] [1565].

Tsunker's and Kostyakov's formulae for permeability to water are briefly discussed and the former is considered insufficiently developed for practical use. In field experiments with intermittent watering of insulated monoliths it was found that absorption values approached constancy only during the third and fourth waterings, after 25–30 hours, when the soils were saturated, absorption being particularly rapid in the first 2½ hours. The coefficient of initial absorption fell regularly in successive waterings, but at different rates for different soils; a further factor connected with character of the soil showed values (during earlier waterings) about twice as high for a heavy clay-loam as for a medium clay-loam. Stress is laid on the distinction between initial absorption, which is much affected by cultivation, micro-relief, presence of humus, etc., and internal permeability in the sense of steady percolation, which is much less variable, particularly where the parent material of the soil is constant. Thus at Istrinsk, in medium and strongly podzolized soils, initial absorption in mm. for the first hour was 136 under forest, clover 110, arable 86, meadow pasture 53, but later the rate averaged 4·5 ± 0·56 mm. per ½ hour with no marked difference due to type of cultivation. Results show the importance of thorough wetting in permeability tests.

Methods are discussed and it is concluded that the insulated monolith is best for field tests. The All-Union Forestry Research Institute (VNIILKh) has used the following method during hydrological investigations. Soil is dug out to leave a circular monolith 120–130 cm. in diam., the top surface of the column being protected by plywood or tarred paper during digging. Depth varies with the soil, but where a less permeable layer (e.g. hardpan) is present the column must be excavated to at least ½ the thickness of this layer. The monolith is next reduced with a sharp knife to 113 cm. diam. and the smoothed surface is finished by smearing with clay, and tarred paper, also smeared with clay, is wrapped round, after which the trench is filled in, watered and stamped down. Thus made, the monolith stands up well to the winter. Watering is done with measured amounts of water from a height of 50 cm. and excess water is led off from the surface and measured. Five-minute intervals are used for the first ½ hour; thereafter intervals of 10 minutes. After 1–3 days in the first instance, and 2–4 days for later repetitions, the process is repeated until the total amounts to 15–20 hours. For sandy soils the tests may be shorter.

When constructing a common curve for successive watering results, due allowance must be made for the filling of pores that may have drained in the intervening period. The mathematical elaboration of the data by Kostyakov's formula and a modification thereof that appears better for forest clay-loam soils, is discussed. For determining rates of initial absorption in forest soils where litter is present, it is necessary to insulate the soil column to prevent loss of water by spreading. A soil column 50–60 cm. deep and 60–80 cm. in diam. is excavated, cased in an iron jacket 2–3 cm. wider, and the gap filled with disturbed soil stamped down until structureless. The desirability is emphasized of simultaneous comparative tests on different litter types, field soils, etc. Watering is done for 1½ hours at 10-minute intervals, and a repetition made after 1–2 days.

Specific gravity and total porosity are determined from the samples taken with a large metal cylinder of diameter 200–250 mm. and volume 3–5 litres. Notes are included on the determination of field moisture capacity and on its relationship to maximum molecular moisture, available moisture, etc. The determinations are conveniently made on insulated monoliths after permeability tests, when gravitational water has had time to drain away; for sandy soils one moisture determination on the day after watering may suffice; for heavier soils at least two measurements are necessary, after 5–7 and 10–15 days respectively.

Brief accounts are also given of field and laboratory procedure for determining water absorption by litter. Both presuppose sampling of the litter for thickness, weight, and hygroscopic moisture. In the forest, the watering method is employed: in the laboratory this method may be supplemented by wetting for varying periods. These measurements are often very troublesome, particularly with broadleaved species, owing to the difficulty of separating litter and soil.

11.42. Soil Chemistry

11.42.2 : 11.43 : 21.32. Remezov, N. P. Ammonifikatsiya i nitrifikatsiya v lesnykh pochvakh. [**Ammonification and nitrification in forest soils.**] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* No. 24, 1941 (89–128). [Russ.] [1566].

Conditions of nitrogen nutrition are especially important in coniferous forests, since Spruce and Pine consume considerably more nitrogen than any other nutrient element, and at the same time the soil of coniferous is usually poorer in nitrogen than that of broadleaved forests. Consequently it may be expected that a lack of nitrogen will in many cases be a limiting factor in the development of coniferous species. Great importance is therefore attributed to the processes of ammonification and nitrification of organic nitrogen compounds in the soil and in plant litter.

The first secures the conversion of nitrogen from organic compounds unavailable (or little available) to plants into assimilable ammonium-nitrogen, and the more intensive this process, the greater is the amount of mineral compounds of nitrogen in the soil. The second process determines the form of nitrogen nutrition: with intensive nitrification, plants will receive nitrate-nitrogen, in its absence ammonium-nitrogen.

The results of the present investigation show that: (1) Broadleaved species use less nitrogen than conifers. (2) In coniferous forests with a ground flora of mosses, *Vaccinium vitis-idaea*, *V. myrtillus*, or *Calluna vulgaris*, nitrification is absent, or almost so, and vegetation develops under conditions of ammonium nutrition. In coniferous forests with shrubs and a grass layer, a weak degree of nitrification exists, though the ammonium form predominates. In Oak forests nitrification is strong, although it still lags behind ammonification.

(3) After fellings, nitrification rises sharply and proceeds quite rapidly in young plantations, gradually decreasing with age.

(4) Soil cultivation, slash burning, and opening of the canopy cause increased nitrification.

(5) Nitrification in forest soils is inhibited by the presence of specific compounds, belonging to the bitumen group, toxic to nitrifying bacteria. A strongly acid reaction also decreases nitrification and ammonification. Seasonal fluctuations of nitrification are connected with changes in the temperature and aeration of the soil.

It is claimed that Hesselman's observation of a peak in ammonification values at pH 4·5–5·0 and a further peak in nitrate accumulation at pH 5·5–6·0 is best explained by conversion of ammonium- to nitrate-nitrogen in this range of pH values. Hesselman's view that the correlation of high nitrification with soils rich in electrolytes is due to their better physical properties, is also contested. In experiments with compost, nitrification proceeded in spite of unfavourable physical conditions.

The alternative view proposed is that soils with different electrolyte contents bear different forest types and so by variations in the humus provide different media for the development of nitrifying organisms.

(6) The best form of nitrogen nutrition for woody plants has not yet been studied from the physiological point of view; when it is known what the optimum forms of nitrogen nutrition are for a given woody species under given conditions, it should be possible to devise measures to change the relation between the content of nitrate- and that of ammonium-nitrogen in the soil.

11.43. Biology of Soil, including Mycorrhiza

[Mycorrhiza, see Abstract No. 2037.]

11.43.2 (485) : 13.15. FORSSLUND, K. H. Studier över det lägre djurlivet i nordsvensk skogsmark. **[Studies on the lower fauna of the north-Swedish forest soil.]** *Medd. Skogsförsöksanst. Stockh.* 34, 1944–45 (1–283). [Sw.sw.g.] [1567].

A full report on investigations made in coniferous forest of the *Vaccinium*, *Dryopteris* and, to a lesser extent, *Geranium* types in Västerbotten.

Chapter I deals with the natural conditions of the area. It is noted *inter alia* that measurements of soil moisture and temperature for one week each in June and July showed the moisture content of the F layer under closed stands to be at least double that under open ones, and the difference for the H layer was even greater. Variations in both moisture and temperature were considerably greater in open stands, where the maximum temperature of the moss-and-litter layer could reach 59° C., whereas in closed stands 30° was the upper limit.

Chapter II is devoted to methods of study, terminology, etc., and the soil fauna as such. Account is taken only of lumbricids (and to some extent enchytraeids), gastropods and arthropods. Sifting was used to obtain the larger forms, Trägårdh's automatic sampling funnel for the smaller arthropods, and washing out for the enchytraeids. A distinction is drawn between active and passive soil organisms, i.e. those directly concerned in soil processes and dependent on food in the soil and those that merely spend a resting or other relatively immobile stage there. Abundance values are mostly (wherever possible) quoted as total number of specimens per cu. dm. of material, and 5 abundance classes are recognized. Enchytraeids occurred in quantity in all localities, amounting in some cases to 600 per cu. dm. and being most frequent in the F layer and in the *Dryopteris* type. The remaining animals found were mostly small arthropods, mainly Acarina and Collembola. In the moss-and-litter layer the former made up 70–96 and the latter up to 29 per cent. of total fauna per sample: in the humus layer the corresponding figures were respectively (21·6–) 47·6–90 and 8·9–47·9 (–77·1). The total for the moss-and-litter layer varied from 800 to 4,700 per cu. dm. For the humus layer, totals under 5,000 are regarded as poor, 5,000–8,000 normal, and over 8,000 rich. The highest total per cu. dm. was 34,400. The fauna of the F was generally much richer than that of the H layer; minima and maxima per cu. dm. were 3,200 and 34,400 for the former and 1,700 and 14,400 for the latter. Quantitative local variation within a stand could be great, e.g. differences of up to 8,000 per cu. dm. were observed between samples taken in close proximity under young stands, though in older stands such differences seldom exceeded 3,000. The cause of these variations was usually the mass occurrence of one or a few species. During the period from the beginning of July to the second half of October no marked trends due to seasonal variation could be observed. There was no apparent correlation between abundance of fauna and moisture content of the soil cover, and neither temperature nor pH appeared to exert a direct effect. On the other hand, the fungus flora seems to have a marked influence on the composition of the fauna.

Chapter III is concerned with the relation of the fauna to the soil and its processes. The animals of direct importance in this respect are those that live on the microflora and plant remains, e.g. oribatids (and to a lesser extent Collembola) feeding chiefly on mycelia, and worms, gastropods and fly larvae that live on organic remains and their microflora. So far as known, these forms cannot decompose cellulose or lignin and their activity should serve chiefly to hasten the turn-over of nitrogen and to secure great comminution of organic matter. There were no noteworthy differences in specific composition of the fauna between the localities, forest and humus types examined, but considerable quantitative differences did exist. The microfauna was poorest in the *Dryopteris* and *Geranium* types, though the former of these showed the greatest number of larger animals. In young, closed forest of the *Vaccinium* type with a hardwood admixture there were enormous numbers of small mycelium-feeders, of which several species occurred in mass, while larger forms were scarce. In equally closed forest with admixed hardwoods and a ground layer of herbs, especially where the humus was of the mull or 'greasy' types, there was a marked decline in the small forms and a corresponding increase in the larger ones.

As forest of the *Vaccinium* type ages and becomes open, a general impoverishment of the soil fauna takes place and all the animals of major significance in the turn-over of matter in the soil show a great decrease in numbers.

An extensive bibliography is appended.

11.43.2 (485) : 13.15. FORSSLUND, K. H. Sammanfattande översikt över vid markfaunaundersökningar i Västerbotten påträffade djurformer. **[Summary statement of the animals found during soil-fauna investigations in Västerbotten.]** *Medd. Skogsförsöksanst. Stockh.* 34, 1944–45 (341–64). [Sw.g.] [1568].

A systematic catalogue giving the geographical range of each species, N. Swedish forest types in which it occurs and, where known, data on frequency, constancy and abundance in samples taken with Trägårdh's sampling funnel, and occurrence in different soil layers. It is proposed that the term 'zootope' should be employed for the environment of the zoocoenosis, retaining 'biotope' for that of the whole biocoenosis. [Cf. preceding abstract].

11.43.2 : 11.42.1 : 13.15 : 13.2. SEN, A. **Influence of feed on composition of termite soils.** *Curr. Sci.* 13, 1944 (280–1). P.R. [1569].

Bits of paper, wood and cowdung were placed on artificial platforms. The materials were completely eaten by termites every night. The soil built up by the termites was broken up and collected, and fresh material was placed on the platforms until sufficient soil had been collected for analysis, the results of which were as follows:—

		Soil brought by termites feeding on		
Constituents	*Adjacent soil*	*Paper*	*Wood*	*Dried cowdung*
pH	7·5	8·6	8·4	8·1
Sands . . .	76·91	70·36	67·58	69·38
Silt	12·76	13·14	15·04	14·20
Clay . . .	10·33	16·50	17·38	16·42
Carbon . . .	·126	·450	·220	·082
CaO . . .	·31	·49	·74	·69
P_2O_5 . . .	·03	·08	·07	·09
K_2O . . .	·57	·93	·77	1·00

11.44. Surface Humus

11.44 : 11.42 : 11.47. BORNEBUSCH, C. H. Forskellige Bladarters Forhold til Omsætningen i Skovjord. **[The influence of leaves of different species on decomposition in the forest soil.]** *Forstl. Forsøgsv. Danm.* 16, 1943 (265–72). [Dan.g.] [1570].

A report on two laboratory experiments made in continuation of the researches described in *Forstl. Forsøgsv. Danm.* 8 (236 *et seq.*).

(1) When leaves of various species were placed on a good forest mull (hardwoods with *Mercurialis*), those of Elder, Stinging Nettle, *Mercurialis*, Elm, Common and Grey Alder, and *Alnus cordata*, *A. subcordata* and *A. rubra* had the most rapid rate of decomposition, those of Birch, *Prunus serotina*, Hazel, Sycamore Maple, Oak, Red Oak, and Beech showed intermediate rates diminishing in the order given, and those of Norway Spruce, Douglas Fir and Larch were the slowest to decompose.

(2) To test the rate of cellulose decomposition, strips of filter paper were placed on mixtures of leaves of various species with (*a*) a good forest mull of the same type as for (1), and (*b*) a Spruce mor. Both on the mull and on the mor the most rapid decomposition of the filter paper occurred with mixtures including leaves of Elder, Nettle and *Mercurialis*; decomposition was also stimulated to a smaller extent by the presence of leaves of Elm, Hazel, *Prunus serotina*, various species of Alder, and Sycamore Maple, in the soils. Mixtures including leaves of Beech, Birch and Oak did not stimulate decomposition. Of the conifers, Norway Spruce needles inhibited decomposition on the mull but stimulated it on the mor, whereas those of Larch and Douglas Fir inhibited decomposition on the mor and encouraged it on the mull. Decomposition was generally quicker on the mull than on the mor. The addition of $NaNO_3$, at a rate corresponding roughly to the amounts of N afforded by the leaves in the above mixtures,

had no favourable effect upon the rate of cellulose decomposition.

Comparison of the two series shows that, on the whole, the species whose leaves decompose most rapidly also stimulate the decomposition of other cellulosic matter on the soil; thus, provided that light is kept insufficient for unwanted grasses, heather, etc., an admixture of species with readily decomposed litter should promote decomposition in general and improve the condition of the humus.

11.44 : 11.43 : 11.42. WITTICH, W. Untersuchungen über den Verlauf der Streuzersetzung auf einem Boden mit Mullzustand III. **[Investigations on the process of litter decomposition on a mull soil, III.]** *Forstarchiv* 20, 1944 (78–80). [G.] [1571].

A supplement to the paper noted in *For. Abstr.* 5 (232). (i) Even with pre-treatment with 5-per-cent. HCl the fresh litter substance insoluble in acetyl bromide remains in the neighbourhood of 20 per cent.; for simplification this fraction is regarded as humified, but acetyl bromide is not considered suitable for determining true humus material. (ii) The author's results are briefly discussed in connexion with those of Mattson and Koutler-Andersson [*Ann. agric. Coll. Sweden* 9 (1–73)] with particular reference to the latter authors' interpretation of the role of acidoids in decomposition. (iii) Decomposition of Silver Fir litter has proved to resemble that of other conifers, being very slow; after almost 4 years only minor changes were observable in the tissues. Confirmation was obtained of the previous results indicating the particularly slow decomposition of Larch litter.

11.44 : 12.19.23 : 11.43 : 11.42. WITTICH, W. Untersuchungen über die Streuzersetzung auf einem Boden mit Mullzustand IV (Die Streu der Bodenflora). **[Investigations on litter decomposition on a mull soil, IV. (The ground-flora litter).]** *Forstarchiv* 20, 1944 (110–4). [G.] [1572].

Litter of species rich in N, e.g. Stinging Nettle, *Impatiens parviflora*, Raspberry, Blackberry, and various herbs, decomposed rapidly. That of *Vaccinium myrtillus* took about as long as Lime, whereas that of *V. vitis-idaea* was even slower than Beech litter in decomposing. Bracken and grass litter remained with little apparent change for 2 years, after which they began to fall to pieces: in nature, dead grasses are in pieces on the ground after about 2 years and decomposition then proceeds rapidly, aided by worms, etc., until completed in about the same time as that of Beech litter on mull soil. Even with inferior grasses on poor soils where Beech forms deep humus, there is no marked accumulation of grass humus. The ash content of grass litter was not low, but its mineral contents (means of 9 species), in percentage of means for 19 species of broadleaved litter, were: SiO_2 175, CaO 13·7, MgO 35, K_2O 77, Na_2O 58, P_2O_5 63. Grass litter had also low contents of ether-solubles and lignin, and C : N ratios of 39 (*Dactylis glomerata*) to 112 (*Molinia caerulea*) in contrast to the readily decomposed species with C : N ratios mostly below 30. Free acids, acidoids and acidification values by Mattson's method were strikingly low in litter of grasses, which explains why biological soil conditions are comparatively favourable and decomposition continuous under grass, despite the low content of bases. Furthermore, owing to the peculiar chemical composition of the litter, the acid intermediate products of decomposition play only a minor part. [Cf. preceding abstract.]

11.44 : 11.43 : 11.42. SHUMAKOV, V. S. Dinamika razlozheniya rastitel'nykh ostatkov i vzaimodeystvie produktov ikh razlozheniya s lesnoy pochvoy. **[The dynamics of decomposition of plant remains and the reactions of their decomposition products with the forest soil.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* No. 24, 1941 (19–88). [Russ.] [1573].

The material for the series of lysimeter studies described consisted of (i) needles of Pine and Larch and leaves of Birch, Poplar and Elder shaken in autumn from the plants and air-dried before use; and (ii) natural litter of Pine and Spruce, taken to include the whole of the litter horizons but to exclude the soil proper, and used at the natural moisture content to avoid destroying any organisms present. The soils used were a sandy loam and a clay loam, both of medium podzolization.

A. *The course of decomposition in autumn needles, leaves and natural forest litter*: (i) The nitrogen and mineral-salt content of tree and shrub foliage falling in autumn depends on locality factors and biological characters of the species. (*a*) The lowest nitrogen and mineral content was found among the conifers in Pine needles, and among the broadleaved species in

Birch leaves. (*b*) There is little difference in the base content of leaves of Poplar and Elder; these contain about 4 times as much calcium and magnesium as Pine needles, and both are equally recommended for improving biochemical conditions of decomposition in coniferous litter. (*c*) The nitrogen and phosphorus contents of Pine litter are twice as high as those of autumn Pine needles.

(ii) The rate of decomposition in autumn needles, leaves and litter depends on their content of readily soluble compounds; the higher this content in the litter, the more rapid is the rate of decomposition.

(iii) The pH of the decomposition products of plant remains varies for the different products within definite limits. Up to the middle of the first vegetative period (26th August) the products of decomposition were subject to alkalization; later acidification occurred, reaching in October the initial pH value. The pH of decomposition products of deciduous species was more alkaline than that of coniferous products. The course of pH values, as decomposition proceeds, appears to vary for the same species in different years of observation and to depend on weather conditions.

(iv) In the eleven months November–October, leaching due to precipitation caused the following percentage losses based on dry weight: Pine needles 2·9, Elder leaves 9·7, Pine litter 0·17. Leaching of mineral portions of the plant remains was considerably faster, e.g. for the same period the percentage losses of mineral salts, based on initial salt content were: Pine needles 24·7, Elder leaves 32·4, Pine litter 0·61.

(v) Maximum leaching of magnesium and calcium from decomposing foliage and litter does not coincide with the maximum leaching of nitrogen and phosphates, the two latter being subject to secondary fixation by micro-organisms. The poorer the plant remains in nitrogen and phosphates, the greater is the influence of such secondary fixation in the decomposition process, i.e. leaching is slower.

(vi) Leaching of magnesium from decomposing foliage and litter is more rapid than that of calcium. In eleven months 80 per cent. of the total magnesium, but only 8·99 per cent. (Elder) and 14·69 per cent. (Pine) of total calcium was removed by leaching.

(vii) In the Pine and Elder foliage residues, after decomposition and leaching by precipitation, the percentage of nitrogen and mineral elements (with the exception of magnesium) based on dry weight were higher than in the initial material. Further, the more rapid the process of decomposition, the greater was the relative increase of nitrogen and minerals (with the exception of magnesium) in the residues.

B. *Reactions of decomposition products of plant remains with the soil*: (i) Absorption of nitrogen and mineral elements by sandy and clay soils of medium podzolization, from the decomposition products of Pine and Elder leaves, depends on the nature of the products and the type of soil. Over a period of 11 months the substances absorbed, in grammes dry weight per kg. of soil, were: for the clay-loam from Elder leaves 16·38, from Pine needles 3·49; and for the sandy loam from Elder leaves 7·19, and from Pine needles 3·22.

(ii) The water-soluble organic substances of the decomposition products of Pine and Elder leaves are absorbed by both soil types at a greater rate than the mineral elements.

(iii) There is evidence of some regularity, due presumably to a microbiological cycle, in the course of calcium, magnesium, nitrogen and phosphorus absorption from the decomposition products by both soils.

(iv) For both soils absorption was most active in June, when the sandy soil absorbed 61–80·1 per cent. and the clay-loam 67·1–90·8 per cent. of the total mineral-elements content of decomposition products of Pine and Elder leaves.

(v) The amounts of decomposition products, in mg. per kg. soil absorbed from Elder leaves over a period of 11 months, for sandy and clay-loam soils (results for clay-loam in parenthesis), were CaO 388·45 (325·02), MgO 730·07 (808·57), N 59·14 (145·36), P_2O_5 42·7 (90·2); corresponding amounts from Pine leaves over the same period were—CaO 210·31 (135·36), MgO 89·89 (136·36), N 64·69 (63·03), P_2O_5 5·48 (9·04).

(vi) The rate of nitrogen and phosphorus absorption by both soils is proportional to that of water-soluble organic substances.

(vii) The decomposition products of Pine litter, in contrast to those of autumn Pine needles, are not absorbed by sandy podzolic soil, but on the contrary remove organic and mineral soil constituents by leaching considerably more than does precipitation: in 11 months this soil lost 0·602 g. dry weight per kg. by leaching due to decomposition products of Pine litter.

(viii) For the same period, leaching of the sandy soil by products of Pine litter resulted in losses, in mg. per kg. soil, of CaO 98·74, MgO 69·94, N 4·01, while 0·88 of phosphoric acid was absorbed by the soil.

(ix) As a result of the reactions of the two soils with the decomposition products there were changes in the representation of absorbed bases and the degree of base unsaturation: (*a*) Decomposition products from Elder leaves increased the absorption capacity of both types of soil, and their base unsaturation decreased in consequence of a decrease in the absolute amount of absorbed hydrogen. (*b*) Positive effects of the decomposition products from Pine needles and litter were an increased absorption capacity and decreased base unsaturation, but in both soils the absolute unsaturation values remained almost unchanged.

(x) Absorption from decomposition products of Pine and Elder leaves, and soil reactions with those of Pine litter, considerably increased total nitrogen and free phosphoric acid in both soil types as compared with controls.

11.44 : 11.43.1 : 31.42.1 : 12.19 : 12.21 : 12.25. CHASTUKHIN, V. Ya. Ekologicheski analiz raspada rastitel'nȳkh ostatkov v elovykh lesakh. **[Ecological analysis of the decomposition of plant residues in Spruce woods.]** *Pedology* No. 2, 1945 (102–14). [Russ.e.] C.G.B. [1574].

The results are described of an investigation of decomposition by the higher fungi which, under forest conditions, play the leading part in this process. In the method used, a preliminary reconnaissance is made of the mycoflora of a block of forest and plots of 100–500 sq. m. are laid out in the most typical portions of different associations, divided into 5-m. quadrats, and a map made to show logs and stumps, different litter types, distribution of fungi and their sporophores.

Most of the paper is devoted to results for mixed, storeyed Spruce woods with a herbaceous ground layer and mull soils. Here the main phase of Spruce wood decomposition (broken and windthrown trees, stumps, etc.)—the brown-rot stage—was accomplished chiefly by *Armillaria mellea* and *Fomes pinicola* and the next (red-rot) stage chiefly by *Omphalia campanella* and *Paxillus involutus*. Wood of the deciduous species (Rowan, Maple, Ash, etc.) was decomposed mainly by *A. mellea*, followed by *Pluteus cervinus*, *Flammula alnicola*, *Collybia platyphylla*, *Mycena pelianthina* et al. The mycoflora of litter was a mixture of agarics characteristic of Spruce and hardwood associations. On Spruce litter the most important were *Marasmius perforans*, *Mycena galopus* and *M. vulgaris*: on hardwood litter the chief species were *Collybia confluens*, *Mycena epipterigia*, and *M. galericulata*; forms characteristic of Birch woods, e.g. *Lactarius subdulcis*, *L. turpis*, *Mycena pura* and *Amanitopsis vaginata*, were also present.

For Spruce forest types in general, fungus successions on Spruce wood begin with fungi living on the cell contents, often accompanied by *Polystictus abietinus* developing on the bark. The next phase is usually *Lenzites sepiaria* in open places and *Fomes pinicola* in forest, though *Armillaria mellea* may be dominant in the storeyed Spruce type as above. In the third phase *Boletus felleus* and *Paxillus involutus* are the commonest agents in the *Sphagnum* and *Vaccinium* types.

As regards decomposition of wood of associated deciduous species, that of Birch commonly starts with *Fomes fomentarius* or sometimes *Polyporus betulinus*, and more rarely *Polystictus versicolor* or *Polyporus cinnabarinus*, followed by *Pluteus cervinus*, *Hypholoma fasciculare*, and *Pholiota mutabilis*, *Helvella infula*, et al. Aspen decomposition is accomplished in the first place almost always by *Fomes igniarius*, and this is followed by species such as *Hypholoma fasciculare*, *Pholiota mutabilis*, *Armillaria mellea* and *Collybia platyphylla*.

In the *Sphagnum* and 'green-moss' Spruce types the chief litter fungi are *Marasmius perforans*, *Mycena* spp., and *Cortinarius* spp. Litter in temporary Birch forest shows mainly *Entoloma hydrogrammus*, *Lactarius subdulcis*, *Mycena pura*, *Clitocybe infundibuliformis* and *Collybia dryophila*.

In conclusion it is stressed that the ecological approach offers a sound basis for further research, particularly as it enables work to be concentrated on the most important species in the fungus flora. Studies of the type described in this paper should be followed by more detailed physiological and autecological researches on higher fungi and by studies of the microflora and microfauna of plant remains, etc.

11.44 : 12.26–8 : 12.21. HARRIS, G. C. M. **Chemical changes in Beech litter due to infection by *Marasmius peronatus* (Bolt.). Fr.** *Ann. appl. Biol.* 32, 1945 (38–9). L.S. [1575].

Investigations were carried out to determine the chemical effects of this litter-destroying fungus, using methods similar to those employed for wood-destroyers, and to discover whether such an investigation sheds any light on the ecological relationship existing between fungus and substrate. Uninfected leaves, dark brown and brittle when dry, and infected leaves, straw-coloured, thin, fragile and covered with mycelium, were collected from the deep litter in a pure Beech wood. The results of analysis show the work of a vital process involving loss of carbon and that the fungus decomposes lignin, converting it into soluble products by the action of exoenzymes. It is suggested that by this process it contributes to conditions favourable for Beech regeneration. The lignin content of the undecayed leaves is much higher than is usual in timber. It seems probable that *Marasmius peronatus*, possessing, in common with white rots, the ability to break down lignin, and being particularly active in deep litter, may play an important part in the rapid conversion of Beech debris to an assimilable form. Observations in culture by the author show conclusively that the aeration requirement of the fungus precludes development injurious to timber; also its growth is not so rapid in the presence of the essential oils of conifers; for favourable growth of this species, a substrate should not necessarily contain much cellulose but should certainly have a considerable proportion of unchanged lignin.

11.47. Maintenance of Favourable Soil Conditions

11.47.1 : 23.26.4 : 12.25 (77). AUTEN, J. T. **Response of Shortleaf and Pitch Pines to soil amendments and fertilizers in newly established nurseries in the Central States.** *J. agric. Res.* 70, 1945 (405–26). [Central States Forest Exp. Sta., U.S. Forest Service.] O.R.E. [1576].

An account of 5 years' experimentation (beginning in 1936) on the effect of different fertilizer materials and soil amendments on the growth of Shortleaf and Pitch Pine seedlings in newly established forest nurseries in Ohio, Indiana, and Missouri, on land previously used for agriculture.

Results indicate that well disintegrated peat is probably the best means of adding organic matter to nursery soil. All the forms of nitrogenous fertilizer used in the experiments reduced seedling density where applied at sowing time. Soluble nitrogenous fertilizers were most beneficial where applied about 2 weeks after seedling emergence. It seems probable that nitrates have an undesirable effect on Pine seedlings in the early stages. Pine seedlings often failed even on soil containing ample mineral nutrients, probably owing to the lack of mycorrhizal associations. Apparently the most satisfactory form of phosphatic fertilizer for Pine nursery soil is treble superphosphate.

11.47.13. GUINAUDEAU, J. Une expérience d'emploi d'engrais sur plantations forestières. **[An experiment in the use of fertilizers in forest plantings.]** *Rev. Eaux For.* 83, 1945 (343–51). [F.] [Syndicat de Reboisement du Béarn, 72, rue de Castelnau, Pau.] [1577].

The experiments described in this article were carried out at Ogeu (Basses-Pyrénées) in order to study the effect of the principal fertilizers on forest plantings on very poor soil and particularly on the four species most commonly employed in that region: Corsican Pine [*Pinus nigra* var. *corsicana*], Douglas Fir [*Pseudotsuga taxifolia*], Red Oak [*Quercus borealis* var. *maxima*], and Japanese Chestnut [?*Castanea crenata*]. Rows of plants were given one or other of the following treatments, applied to each hole before planting: 20 grammes lime, 40 g. lime, 10 g. sulphate of ammonia, 15g. basic slag, 10 g. potassium chloride, and various combinations of these. Planting was done in December 1938 and initial survival was excellent in all species. The effects of application of fertilizers were apparent during the first 3 years of growth and then ceased to be noticeable. Details are given of the results achieved with the various species, which on the whole establish the beneficial effect of lime (except in the case of Japanese Chestnut which seems to have the same calcifugous character as the European species) and the neutral or even harmful effect of sulphate of ammonia. It is concluded that in very poor heath soils, particularly those very deficient in lime, the application of small quantities of fertilizer at the time of planting will have a favourable effect on the growth of young plants, enabling them rapidly to emerge from the surrounding vegetation and often obviating the necessity of subsequent cleaning. Twenty or 30 grammes of lime should be introduced into the planting holes about a month before planting, and covered in. At the time of planting, 15 grammes of basic slag, and 15 grammes of potassium chloride should be introduced into the hole. The lime should be omitted in planting Chestnuts.

11.49. Soil Types

11.49.1 (47.9) : 91.3. GULISASHVILI, V. Z. O progradatsii lesnȳkh burozemov verkhnego gornogo poyasa Kavkaza. **[On the 'progradation' of forest burozems in the upper mountain belt of the Caucasus.]** *Pedology* No. 7, 1942 (26–35). [Russ.e.] L.S. [1578].

Dshavakhetia, in the southern part of Georgia, is one of several steppe regions formerly covered by Pine and other forests; its present vegetation is chiefly high mountain steppe.

Forest vegetation occupies an insignificant area and is represented by *Pinus sylvestris*, *Quercus macranthera*, *Betula verrucosa*, *Populus tremula*, *Salix caprea*, *Pyrus communis*, isolated trees of *Picea orientalis*, with undergrowth of *Corylus avellana*, *Rosa pimpinellifolia*, *Lonicera caucasica*, *Cotoneaster vulgaris*, *Ribes alpinum*, etc.

The soil under forest has hitherto been considered as burozem and that under steppe vegetation as chernozem. In the author's view, based on investigation of the flora and the soil, the steppe soil was formerly forest burozem, and has the appearance but not the structure of chernozem. The present steppe is believed to have been formed by destruction of the forest, and fellings probably resulted in the following changes: disappearance of litter (A_0); enrichment of the upper horizons in humus, producing a gradual change to darker coloration and the outward appearance of chernozem; nut and fine-nut structure of the upper horizons gradually converted into granular structure; increased base adsorption and a decrease in adsorbed hydrogen. No change appears to have occurred in the distribution of sesquioxides or of 'physical' clay in the horizons.

The earlier the forest soil was cleared of forest, i.e. the longer it has been subjected to the influence of the steppe vegetation, the more evident are these changes. The process has a great deal in common with the process of 'regradation' of degraded chernozem. It is suggested that the former forest soils should be called 'progradation burozems' and the steppe soils 'prograded burozems'.

11.6. *Hydrographical Conditions. Water and Soil Conservation*

11.62 : 11.14.4. MURASHEV, S. I., and KUZNETSOVA, Z. I. Rukovodstvo po izucheniyu snegovogo rezhima v lesakh. **[Guide to the study of the snow régime in forests.]** *Trud. vsesoyuz nauchno-issledov. Inst. lesnogo Khoz.* No. 4, 1939. pp. 41 + 1. [Russ.] [1579].

A first guide, which attempts to secure uniformity in research methods for this subject, based on work done by the All-Union Forestry Research Institute in 1937–38. The chapters are: (i) Influence of forest stands on the snow régime, including a general review of the hydrological rôle of forests; the snow régime of catchment areas as the basic factor in spring flooding; the snow régime of large blocks of forest; the planning of investigations, with special reference to statistical requirements. (ii) Collection of snow mensurational data, with sections on choice of sample sites; technique of measurement, and determination of snow density; description of the process of thawing; and determination of the reserves of snow on small catchment basins.

Standard forms are given for recording the data required, which would include stand composition and structure; distance between sampling points; snow depth and density; position of sample in relation to trunks and crowns; depth of soil freezing; depth of ice crust or water under snow; observed stages of thawing; soil, relief and aspect. (iii) Initial mathematical elaboration of data, including notes on the determination of the standard deviation. (iv) Elucidation of correlations between stand characteristics, climate, and characteristics of the snow régime, including sections on the mathematical expression of the factors involved and the statistical demonstration of correlation.

11.62 : 11.14.4. MURASHEV, S. I., and RUTKOVSKI, V. I. Metodika izucheniya snegovogo rezhima v lesakh. **[Methods of studying the snow régime in forests.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* No. 14, 1940. pp. 32. [Russ.] [1580].

This is a supplement to and partial revision of a guide published previously [cf. preceding abstract], based on further experimental work, with some improved and simplified methods including the use of nomograms (alignment charts) instead of equations. The effect of the changes may save as much as 60–65 per cent. of the work involved, and not only can less highly qualified staff be used, but the improvements enable many more sampling points to be established. The subject matter is discussed under the headings: general notes; choice of sampling areas and points; sampling; snow-density determinations; ocular observations of thawing; initial elaboration of material; determination of accuracy; determination of standard error for volume of water in snow; supplementary calculations when an ice crust is present; comparison of results; and composition of explanatory notes. Eleven nomograms are appended.

11.62.1 (54). GLOVER, H. **Soil erosion.** *Oxford Pamphl. Indian Affairs* No. 23, 1944. pp. 32. [1581].

A short account of the causes, extent and progress of erosion in India and the measures necessary for controlling it.

11.62.11 : 11.62.31. KIRWALD, E. Bekämpfung des Bodenabtrags und Regelung des Wasserhaushalts in Gebirgen. [**Control of soil erosion and regulation of the water régime in mountainous regions.**] *Abstr.* in *Forstwiss. Cbl. u. Thar. forstl. Jb.* No. 1, 1944 (37–40). [G.] [1582].

A statement of the problem on conventional lines, with a final note on the tasks of soil and water conservation awaiting the German forester in eastern Europe.

11.62.11 (44) : 23.3. BUFFAULT, P. Histoire des dunes maritimes de la Gascogne. [**History of the maritime dunes of Gascony.**] Editions Delmes, Bordeaux, France. 1942. pp. 446. [F.] [1583].

The maritime dunes of Gascony are among the largest in the world, and their fixation by afforestation was one of the greatest achievements of its kind in the 19th century. There is a copious literature on the subject, but it consists, for the most part, of scattered papers dealing with particular details. The present work, which deals with the subject as a whole, is a comprehensive and fully documented study with many illustrations. It quotes many original documents, and also draws upon the author's long familiarity with the region.

The Maritime Pine (*Pinus pinaster*) is the principal species in the forests which now cover the dunes; in the north of the Verdon dunes, the Evergreen Oak (*Quercus ilex*) forms a large proportion of the stands and is in some places dominant. Both of these are indigenous species. Many attempts have been made to introduce exotic species, but so far without success. The state forests are managed in two ways. The protection areas are treated as selection forest, the other areas as even-aged forest with regeneration by clear cutting and successive thinnings in youth. The rotation adopted is 72 years in the east and centre, and 56–68 years in the west. Resin tapping is generally practised; it commences when the Pine attains a girth of 1·05 m. at breast height. The period of tapping has now been reduced to 4 years. In the protection area moderate tapping and prudent selection cuttings are the rule. [Cf. *For. Abstr.* 7 (No. 1770).]

11.62.11 (56.9) : 97.1. LOWDERMILK, W. C. **Palestine: land of promise.** Victor Gollancz, Ltd., London. 1945. pp. 167 + plates. Price 4s. 6d. [1584].

This book is the result of a visit in 1938 made by a land conservationist to study the land record of the Near East. As a background to his appreciation of the Jewish re-colonization of Palestine the author provides accounts of the geography and climate of Palestine and Trans-Jordan, the archaeology and history, and the modern industrial development of the country. All of these aspects are used in reconstructing the land record of the area from its primaeval state through decline to renaissance.

The author finds much resemblance between the features of the natural vegetation of Palestine and of California, particularly in the original distribution of the forest types. One of the outstanding species in the original forests of Palestine was *Pinus halepensis* in the highlands, while Oaks, e.g. *Quercus ithaburensis*, formed woodlands in the maritime plain, and cedars grew in Lebanon. Large-scale reforestation is required both as a measure of soil conservation and in order to provide timber, fuel, food, and fodder. According to latest official statistics there are over 185,000 acres of land designated by the Palestine government as forest reserves, in which there has been some planting, but for the most part the only measures taken are closure to goats and fuel gatherers in order to encourage natural regeneration. There are also some 9,000 acres of private forest, mostly planted by the Jewish National Fund, which are better stocked. . In the hill region of Trans-Jordan are about 100,000 acres of forested land where unrestricted grazing prevents re-stocking and is likely to diminish this remnant of ancient forest still further.

11.62.11 (94) : 23.3. TERRY, M. **Soil erosion in Australia.** *Geogr. J.* 105, 1945 (121–9). O.G. [1585].

This paper is a summary of an account based on information obtained by visits to research stations and Soil Conservation Boards in Australia and from recent publications. The writer reviews the history and present state of erosion in Australia and the measures being taken against it.

An example of what can be done in the way of afforestation is to be found at Broken Hill in New South Wales, where trees have been planted on about 3¼ sq. miles of eroded ground round the town, fenced off for the purpose. A belt of trees and shrubs, ¼ to ½ a mile wide, now surrounds the town. Eighteen varieties of Eucalypts, thirteen Wattles, and many other indigenous and exotic species have been established in a very short time. Cuttings of Tamarisk (*Tamarix aphylla*), imported from California in 1936, besides providing hundreds of cuttings for further planting, have grown into trees 30 ft. high. Red Gum (*Eucalyptus camaldulensis*) and *E. intertexta* have in 5 years grown 20 ft. high. Except that reserves were fenced to exclude stock and rabbits, no artificial aids were used. The regeneration of perennial herbage, on the other hand, has been disappointingly slow. In South Australia research is being carried out on the regeneration of Mulga (*Acacia aneura*) and Myall (*Acacia sowdeni*) bush. A long-term experiment is in progress by the Waite Institute at Yudnapinna, where 5 sq. miles have been divided into 14 plots of 160 acres each, with two large reserves in addition. The object is to find out how shrub steppe reacts to different degrees of grazing and to examine the preservation and economic use of pasture in low-rainfall areas.

11.62.11 : 32.91.1. HOOVER, M. D. **Careless skidding reduces benefits of forest cover for watershed protection.** *J. For.* 43, 1945 (765–6). [Appalachian Forest Exp. Sta.] [1586].

A study of the effects of logging is being made at the Coweeta Experimental Forest, as part of a comprehensive investigation of water resource management. Here, in the high-rainfall belt of western North Carolina, skid roads have been found to be an important source of sediment for streams draining forested catchment areas. In a 3-month period June–August, 1942, 250 cu. ft. of sediment were trapped from a portion of a skid road 450 ft. long, 5 ft. wide, and with an average gradient of 30 per cent. This rate of loss is 4,370 cu. ft. per acre of road surface for the 3-month period. Measured soil loss from a comparable area of cultivated land is about 80 cu. ft. per acre for a period of 20 months. The important point is that skid roads themselves are potential or active gullies, and may contribute more sediment to a stream draining a forested catchment area than would result from occasional patches of steep land in cultivated crops.

Location of the road is of the greatest importance, because it is more difficult to control erosion on very steep sections. To minimize soil losses, water should be turned out of the trails, wherever necessary, to prevent its accumulation. Water breaks should be maintained and kept open. Some large operators have found that this simple maintenance reduces logging costs, and find it profitable to assign a man full-time responsibility for the job. Corduroy, built up by laying poles across the trail, is a very effective means of preventing erosion and is often done for easier skidding. Operations should be arranged so that all products are removed at one time, so as to shorten the period of active operations.

12. FOREST BOTANY. TREE SPECIES

12 : 01.2. DAYTON, W. A. **What is dendrology?** *J. For.* 43, 1945 (719–22). [Division of Dendrology and Range Forage Investigations, U.S. Forest Service, Washington, D.C.] [1587].

The writer gives an historical résumé of the meanings attached to the word ‘dendrology’ from 1662 to the present time and concludes with a proposed definition.

12.1. *General Botany*

12.1 : 09.2. MANGHAM, S. **Earth's green mantle: plant science for the general reader.** The English Universities Press, Ltd., Little Paul's House, London, E.C.4. 1939 (reprint 1944). pp. 322 + plates. [1588].

This book, written in a picturesque style and designed for the general reader, treats of plant life from numerous aspects. It outlines the history of botany and of the utilization by man of plant life. The vital processes of various types of plant are described in some detail, and the subject matter of the sciences of ecology and genetics is outlined. The illustrations are numerous and well chosen.

12.11. Physiology. Reproduction. Growth

12.11.1 *Metabolism. Plant Constituents. Growth Substances*

12.11.11 : 12.25. GRIFFIOEN, K. **Changes in the composition of the needles of *Pinus austriaca* Link during the ageing process.** *Repr.* from *Rec. Trav. bot. néerl.* 36, 1939 (347–55). [E.] [University College of Technology, Delft.] L.C. [1589].

The growing parts of the needles of *Pinus austriaca* Link are rich in water, in products soluble in ether and in alcohol-benzene, very rich in tannin, but poor in cellulose, pentosan, lignin, and pectin. The full-grown parts a short distance from the base have a fairly constant composition during the ageing of the whole needle. The percentage of dry matter is higher and that of soluble compounds lower. The content of cellulose and pentosan has considerably increased but the percentage of pectin has not changed. Microchemical reactions showed an important increase in lignin and a considerable decrease in tannin. *From author's summary.*

12.11.15. GREAT BRITAIN. **Annual report (thirty-second year), 1944: East Malling Research Station, near Maidstone, Kent, 1st January, 1944 to 31st December, 1944.** The Kent Incorporated Society for Promoting Experiments in Horticulture. No. A28, 1945. pp. 137. [1590].

Experiments are described in which synthetic growth substances were applied to established Plum rootstock layer beds in the form of sprays and dusts. In one experiment the crop of rooted shoots was increased by spraying, but in two others of similar size, and in one large-scale experiment, negative results were obtained. It is concluded that such spray treatments, in the absence of wounding, are unlikely to have any practical value (p. 36).

12.11.15 : 12.11.12. FERRI, M. G. **Preliminary observations on the translocation of synthetic growth substances.** *Contr. Boyce Thompson Inst.* 14 (2), 1945 (51–68). [1591].

Synthetic growth substances applied as solutions to the soil of potted tomato and *Cleome* plants can be absorbed and transported upwards in an amount sufficient to induce root formation on leaf cuttings taken some time after treatment. Indolebutyric, naphthaleneacetic, indoleacetic, and 2,4-dichlorophenoxyacetic acids have been tested. The upward movement of synthetic growth substances is not stopped by a ring of dead tissues in the middle of the stem and is evidently independent of the activity of living cells.

No movement of synthetic growth substances was detected on leafless *Hibiscus* cuttings when a segment of wood was removed for a distance of 5·5 cm. from the base and the bark alone was dipped into the solution for a distance of 2 cm. When the bark was removed and the wood was left alone for the same distance, the movement was even more intense than when both wood and bark were present. The bark, therefore, not only did not transport the growth substances, but also in some way decreased the amount transported by the wood. It is suggested that when the bark is removed, some of the chemical enters through the lateral walls of the wood and moves upwards through vessels which, being plugged at the base, would not be utilized if the impermeable bark were present in the region exposed to the solution. The present results support the theory of upward translocation of solutes in the xylem. *From author's summary.*

12.11.15 : 12.26–8. GRACE, N. H. **Liberation of growth stimulating materials by rooting *Salix* cuttings.** *Canad. J. Res.* 23C, 1945 (85–93). P.R. [1592].

Physiologically active substances were liberated by rooting Willow cuttings and retained by the solution or sand media in which the rooting had occurred.

Root growth was stimulated in dormant

cuttings which were subsequently rooted in the same media, but the effects of the liberated substances on non-dormant material were predominantly injurious. Stimulation or inhibition was related to the concentration of the liberated material. The active substance was thermo-stable and appeared to have effects similar to those of synthetic plant growth stimulants. It has been demonstrated that salicylates were not responsible for the activity. *From author's summary.*

12.11.2. *Propagation. Growth. Development*

12.11.21 : 12.26–8 : 23.23 : 23.1 : 21.1 : 12.14.7. Mork, E. Om bjørkefruktens bygning, modning og spiring. **[The structure, ripening and germination of the Birch fruit.]** *Medd. norske Skogforsøksv.* 8 (No. 30), 1944 (423–71). [Nor.g.] [1593].

Birch 'seed' is a nut with a thin but very water-resistant pericarp consisting of 3 layers of cells which are impregnated with fatty substances; its water resistance is further increased by the presence of a cuticle. Air-dry seed will float on water for several months, and, if the temperature of the water is high enough (about 30° C.), will germinate normally upon the water surface. In low country in S. Norway the seed requires at least 300 'growth units' to ripen, and the catkins do not start to fall until they have received a 'warmth effect' of about 400 'growth units' [cf. *For. Abstr.* 5 (26–7)]. Well ripened seed retains its germination capacity longer and under more unfavourable conditions, and gives a higher plant per cent. than poorly ripened seed. Seed-ripening in lowland Birch takes from 2 months in a very warm to 3½ months in a relatively cold summer.

Alternating temperatures give a higher germination per cent. than constant ones, the highest germination of ripe lowland seed occurring at alternating temperatures with maxima of 30–35°. Though at a constant temperature of 40° no germination occurs, ripe seed germinates satisfactorily at temperatures alternating between 17° and 40°. Unripe seed appears to be more sensitive to such high temperatures. For ripe seed the minimum appears to be about 20° and at 25° about half of the seed will germinate; poorly ripened seed required a minimum temperature about 5° lower. Seed from mountain forests requires a minimum of 20° for germination: the optimum is 17–35°, but the optimum range is narrower than for lowland seed, as only about half the seed will germinate with temperatures of 17–30°. These results apply to stored, air-dry seed; previous researches, however, show that seed overwintering in the soil undergoes changes enabling it to germinate at lower temperatures.

Well ripened seed is formed in the mountain forests even in years with a summer temperature 0·5° below normal, hence poor seed-ripening is not likely to be the cause of the predominantly vegetative reproduction of Birch in these forests. The best means of encouraging natural regeneration should be strip fellings about 40 m. wide, with removal of all bushes that intercept any quantity of sunlight and precipitation, and in combination with burning and protection from grazing.

In nurseries the best results may be expected from autumn sowings; spring sowings will also give good results, but in this case the beds should be saturated with water before sowing. Laboratory experiments indicate that sowing under glass is best, and no covering of the seed is then necessary. If sand or ash coverings are used their depth should not exceed 1 mm.

As germination per cent. varies with season, and low autumn and winter results are apparently due to low temperatures, it is recommended that for germination tests of Birch seed higher temperatures should be used than those normally employed for cereal and meadow crop seeds.

12.11.22 : 12.11.15. Grace, N. H. **Responses of plant stem cuttings treated with chemicals in a carrier dust.** *Canad. J. Res.* 23C, 1945 (115–28). P.R. [1594].

Plant stem cuttings were treated in a factorial series with talc dusts containing naphthylbutyric acid, nutrient salts, an organic material disinfectant, finely divided silver metal, thiamin and nicotinic acid. Naphthylbutyric acid treatment increased the number of roots for cuttings of *Physocarpus* and *Iresine* and reduced the mean root length of *Lonicera.* Nutrient salt treatment increased the number of roots on *Iresine* cuttings and the mean root length of *Lonicera.* Differential effects were found for treatment with naphthylbutyric acid and each of organic mercury, metallic silver and nutrient salts. Organic mercury at 50 p.p.m. and metallic silver at 5,000 p.p.m. were similar in their effects. Thiamin and nicotinic acid had no significant effect on the rooting responses. Naphthylacetic acid was prepared in talc at concentrations of 4,000, 2,000, 1,000 and 500 p.p.m. and indolylbutyric, naphthylbutyric acids, and potassium naphthylhexoate at molecularly equivalent concentrations. When applied in a talc carrier dust to cuttings of seven species, naphthylacetic and indolylbutyric acids were substantially similar in their effects, while naphthylbutyric acid and potassium naphthylhexoate showed a lower order of physiological activity. Effects of chemicals judged by the rooting responses of cuttings tended to be similar over the concentration range. On the average the 4,000 p.p.m. dosage was injurious, while the two lowest dosages failed to differ in effects between themselves. *Author's summary.*

12.11.22 : 12.26–8 (56.9). Lishziner, M. **A suggestion for the growing of Cork Oak in Palestine.** *Hassadeh* 25 (2), 1944 (43). [Heb.] L.S. [1595].

Experiments in growing Cork Oak on a commercial scale have recently been made in the subtropical regions of the U.S.S.R. By grafting the Cork Oak on local Oaks, such as Red Oak and Chestnut Oak, it has been possible to grow the trees further north. The prospects of growing the Cork Oak in Palestine are good. There are at present several young Oak forests in that country, and it is suggested that the Cork Oak should be grafted on some of these trees for experimental purposes. The success or otherwise of the Cork Oak appears to bear some relation to the lime content of the soil. In Algeria, for example, the tree grows mainly on soils whose lime content is low.

12.11.23. Iterson, G. van. Modellen en theorieën ter toelichting van het mechanisme den spiraalvormigen groei. [**Examples and theories explaining the mechanism of spiral growth.**] *Repr.* from *Versl. ned. Akad. Wetenschappen* (*Afd. Natuurkunde*) 52, 1943 (58–68). [Du.g.e.f.] L.C. [1596].

12.11.3. *Heredity. Breeding. Races and Questions of Provenance. Cytology*

12.11.3. Richens, R. H. **Forest tree breeding and genetics.** *Joint Publ. imp. agric. Bur.* No. 8, 1945. pp. [v] + 79. [E.e.g.f.span.] [1597].

During the last ten or fifteen years considerable progress has been made in genetical studies with forest trees, with a view to improving the existing stock through selection, breeding and related techniques. At present there is no publication bringing together all the information which already exists in this important field, and it is becoming increasingly difficult for research workers to keep abreast of all modern developments. In addition, many of the more important papers have appeared in comparatively inaccessible German, Russian and Swedish forestry journals, and have not been readily available to those interested in forest tree breeding in the Empire.

This bulletin collates the more important papers on this subject that have appeared since 1930. General principles of tree breeding are described in an introductory section with a brief account of the basic theoretical concepts. The methods so far used include line breeding, the development of hybrids exhibiting heterosis, and the utilization of polyploids.

The selection criteria that have been used by tree breeders include timber yield, photoperiodic adaptation, high reproductive capacity, tree shape, wood quality, competitive ability, and resistance to bacteria, fungi, insects, viruses, low temperature and other unfavourable environmental conditions. These characters are considered in general and with special reference to the tree genera treated in the bulletin, viz. *Abies*, *Cupressus*, *Juniperus*, *Larix*, *Picea*, *Pinus*, *Pseudotsuga*, *Sequoia*, *Tsuga*, *Acer*, *Aesculus*, *Alnus*, *Betulus*, *Buxus*, *Carpinus*, *Carya*, *Castanea*, *Eucalyptus*, *Fagus*, *Fraxinus*, *Ilex*, *Juglans*, *Platanus*, *Populus*, *Pterocarya*, *Quercus*, *Robinia*, *Salix*, *Tectona*, *Tilia* and *Ulmus*.

A glossary of the technical terms used in the bulletin and a bibliography of 605 references are appended.

12.11.3. Champion, H. G. **Genetics in forestry.** *Emp. For. J.* 24, 1945 (12–3). [1598].

This article deals with some of the practical applications of the results obtained by genetical research. One important generalization that can be made from past experiments is that the indigenous stock is usually the best for use in any region provided that altitude is not much altered. It must, however, be remembered that what one now finds may not be the true indigenous stock, and that, even if it is, continuous selective felling of the best trees may have left the inferior genotypes. Where random introductions have been made, as with Larch in Great Britain, mature stands of good quality are usually a selection from many trials of the stock best suited to local conditions and are safer for further use than new introductions.

Clearly the first step is to select standing crops of good type, and to conserve and manage them expressly for seed production. If good supplies of certified seed are available, it will quickly be preferred, even at considerably higher figures, and for State plantation work it should be used exclusively.

Hybrids and some types with an increased number of chromosomes present further problems, since segregation is likely to occur in their offspring. To retain the good qualities, vegetative reproduction is usually necessary and much progress has been made of late in stimulating rooting.

It is obvious that the greatest opportunities for the application of genetical knowledge is in afforestation work and in plantations involving a change of species, particularly the introduction of exotics. Here the forester, having decided on the species he will grow, has a free choice of stock within the limits of what he can raise himself or get from outside. Under existing conditions, if he does not collect his own seed, all he can do is to get it from a district which he believes to be suitable to his own area and, just possibly, from stands or trees of good form. But even this step is rarely taken, and most practical foresters are clearly not aware of the possibilities, or they would be doing this and pressing for further research in this most promising field.

12.11.3. Perrin, H. La sélection des arbres forestiers. **[The selection of forest trees.]** *Rev. Eaux For.* 83, 1945 (81–9). [F.] [1599].

A review of the application of genetics and tree breeding to forestry, mainly based on recent German and Danish literature. The writer urges that the creation of a laboratory of forestry genetics should form part of the projected reorganization of the Research Station at Nancy.

12.11.3 (485). Sylvén, N. Årsberättelse över Föreningens för växtförädling av skogsträd verksamhet under år 1943. **[Annual report on the work of the Association for Forest Tree Breeding during the year 1943.]** *Svensk PappTidn.* 47, 1944. [*Supplement*] pp. 38. [Sw.] P.O. [1600].

1. *Report on the work of the main institute (Ekebo) by C. L. Kiellunder:*

As the 1941 and 1942 grafts of Spruce and Pine did not give satisfactory results, experiments were started in the spring of 1943 to determine the effect of a number of factors on grafting and to evolve a suitable technique. With Spruce, lateral grafts proved superior to bottle grafts.

In Spruce grown from seed treated (in 1941) with colchicine while germinating, 48-chromosome nuclei have been found, suggesting that the first tetraploid Spruce has been produced. In the material treated in 1942 two types have been found: one (about 90 per cent. of the plants) apparently unaffected, and the other either completely or partially affected, with height growth reduced at first, and with more or less pronounced shortening and thickening of the needles, which were dark green.

Grafts were made in the spring of 1943 of Larch species, particularly *Larix decidua*, *L. sibirica* and *L. leptolepis*, these being the most valuable species for Sweden. Yield experiments were laid out with different species and provenances representing eight stands of European, six of Siberian, and four of Japanese Larch. So far the most promising in rate of growth have been European Larch from Omberg and Mölnbacka and Siberian Larch from Visingsö. Larch breeding operations aim at providing not only first-class races of the pure species but also special hybrids that will be exceptionally vigorous and give a high timber yield. For the latter purpose two special seed plots have been laid out, one to obtain Japanese × European and the other for Japanese × Siberian hybrids.

Exotic conifers are being examined with a view to the discovery or production of races superior in some respect to the indigenous species. The most promising species, other than Larch, appear to be *Picea sitchensis* and *Pseudotsuga taxifolia*. A specially hardy provenance of the former is being used to establish a seed plantation at Ekebo, and smaller plantings have also been made of particularly hardy races and individuals of *Pseudotsuga*, *Picea glauca*, *P. mariana* and *Thuja plicata*.

2. *Report on breeding and other operations on deciduous trees by H. Johnsson:*

In 1943, about 12,000 plants of an improved Aspen, from crosses between *Populus tremuloides* and the Swedish Aspen, were distributed for use in practical forestry. This hybrid is promising as regards rapid growth and resistance to leaf diseases. New crosses of the same type were grown in 1943.

Two 57-chromosome giant Aspens were found in southern Sweden: one, a ♂, at Trua, Sätra Bruk in Västergötland, shows specially good form and high yield; the other, a ♀, on Husby estate at Ålshult in Småland, includes only a few trees 80–90 years old, the largest trunks over 70 cm. d.b.h. and over 30 m. high. Several of these are quite free from stem rot.

In summer 1943 a new Danish method of propagating giant Aspens by cuttings was tried with excellent results; it consists in cutting off, and treating as shoot cuttings, the shoots from pieces of root placed in moss. Such cuttings root vigorously and rapidly.

The first 76-chromosome Aspen developed by H. Nilsson-Ehle produced flower buds for the first time on grafts strangulated or otherwise treated to induce flowering. Hence it will be possible to produce giant Aspens on a large scale by crossing 76-chromosome plants with trees having the normal chromosome number.

Earlier material is now beginning to give valuable data on different crosses, and individual plants are proving superior, e.g. a few plants from crosses between White Poplar and Aspen. Crossings of this type are in general vigorous but extremely sensitive to some fungous diseases; a few, however, have proved unusually resistant as well as having outstanding growth. These plants are now to be propagated on a large scale.

Comparative field experiments with Birch were extended. At the main institute one experiment was laid out to compare different families derived from trees with figured wood and another to compare different, vigorous interspecific hybrids and their parents.

In spring 1944 there were 38,670 plants ready for planting out, including 11,350 from families undergoing selection, 10,405 from 1941 crosses and 16,915 from 1942 crosses. Among these were about 8,000 from a cross between figured Birches. This large collection shows that seed from crosses can be readily produced on a practical scale.

Among the valuable Birches found in natural stands was an extreme curly-Birch type found at Stockby and a vigorous, large-leaved triploid found at Edsbyn.

3. *Report on Alder, Ash and Elm by C. Eklundh:*

Alder. In spring 1943, bottle grafting of Alder species was carried out for the first time, and gave 25 per cent. success. *Alnus glutinosa* was used as stock for scions of *A. glutinosa*, *A. incana*, *A. cordata*, *A. subcordata*, *A. rubra*, *A. hirsuta*, and some Danish material. The method used with promising results in Denmark for maintaining a 'live seed store' for valuable hybrid seed was tried, grafting *A. cordata* scions 10–15 cm. long in older stands of *A. glutinosa* in which trees about 15 cm. in diameter had been cut to breast height for use as stocks.

Crosses were made with the bottle grafts, grown in the illuminated greenhouse, of *A. glutinosa* with *A. cordata*, *A. incana* or *A. rubra* and of *A. subcordata* with *A. glutinosa* or *A. cordata*. Some fruits were obtained and the seed will be sown in spring 1944.

In the vegetative propagation experiments about 10 plus-variants selected from two-year-old plants with the greatest average increment were planted and layered, the branches undergoing treatment with hormone paste or strangulation to induce the formation of adventitious roots. Good results were obtained.

One- and two-year-old colchicine-treated Alders were grown on in pots to obtain early flowering, or raised in the arboretum, where some of the plants were strangulated. Investigation of the stomata and chromosome number in these supposedly mixoploid plants showed that the root-tip cells were predominantly diploid, whereas the variation in the size of stomata suggested that the shoot system had retained its mixoploid character to a greater extent. It is hoped, by vegetative propagation, to obtain pure tetraploids from some buds of these plants.

Ash. More bottle grafts were made with material from élite Swedish Ash and from foreign species. To obtain 'live seed stores', grafts of young branches of *Fraxinus americana* in a 30-year-old stand of *F. excelsior* were tried and, in spite of failure, experience was gained that may bring success in 1944.

Propagation by cuttings treated with hormone solutions continued to give good results. About ten specially chosen plus-variants from the 1940 plants were put in the nursery for use as mother plants in layering.

Elm. The Kärrbogärde Elm with triploid progeny was bottle-grafted on a large scale, then crossed with the ordinary diploid, and about 100 plants were obtained, all triploids. Two more Elms producing diploid pollen and thus triploid progeny on crossing with the normal Elm, were found near the first specimen. On crossing these two special Elms with each other, very little seed was obtained and none germinated. The attempt will be repeated in 1944.

Experiments on the vegetative propagation of Elm by cuttings were continued, some new foreign 4-year-old material grown at Ekebo being included (e.g. *Ulmus americana* and herbaceous cuttings from older trees of *U. pumila*, *U. campestris* and *U. laevis*). In most cases treatment with hormone solutions increased the rooting capacity.

4. *Report on laboratory investigations at Ekebo*:

Colchicine-treated Spruce represented a considerable proportion of the 831 specimens dealt with in the chromosome laboratory, though some were of similarly treated deciduous trees, especially Elm. Investigations were also made of triploid progeny of Elm and hybrid progeny of Birch and of Aspen. Fourteen new tetraploid Aspens were discovered in 1943 among the progeny of normal Aspen crossed with ♂ giant Aspen from Ransäter (Värmland) and Trua (Västergötland).

In the Ekebo chemical laboratory the nature and incidence of abnormal heartwood formation (due to frost damage) in Beech was studied and the results have been published. The wood chemistry and specific gravity of breeding stock of forest trees were also studied, and it is now known that the variation in chemical composition of the wood of the main tree species is great enough to provide definite indications for the breeder.

As relationships in wood chemistry between young and older trees are of interest to the breeder, work has been started on the determination of cellulose, resin and lignin from the stem and terminal shoots in older trees and root shoots and young cuttings of the same trees, Aspen or Poplar being the species used. No definite results have been obtained yet.

Progress reports are also given for the branch stations of the Association.

12.11.3 (489) : 23.23.14. BORNEBUSCH, C. H. Meddelelse fra Dansk Skovforenings Frødvalg. **[Report of the Seed Committee of the Danish Forest Society.]** *Dansk Skovforen. Tidsskr.* 30, 1945 (425–39). [Dan.] [1601].

A list is given, by species, of approved seed stands in Denmark. Under the present arrangements for seed certification the owner of a seed stand uses a white guarantee form, made out in duplicate, one copy accompanying the seed and the other being sent to the Seed Committee's records at Springforbi. Middlemen use a yellow guarantee form made out in triplicate, one copy going with the seed, the second to the Seed Committee's records and the third remaining with the dealer. Seed-extraction establishments use a red guarantee form. The numbered guarantee forms are supplied free of charge by the Seed Committee. The Committee levies a charge of 10 per cent. of the sale price of all seed from approved stands that is sold direct to the user. Twenty nurseries, which are listed, have agreed to keep accurate bookings of their stock and are inspected yearly by an official of the Seed Committee. Each nursery pays 100 Kr. per annum to cover the expense of control.

12.11.3 (494) : 23.23.1. FISCHER, F. Aufgaben, Ziele und Wege der neu geschaffenen Beratungsstelle für Samenbeschaffung und Provenienzfragen an der forstlichen Versuchsanstalt, ETH. **[Tasks, aims and methods of the newly created Advisory Office for Seed Supply and Questions of Provenance at the Forestry Research Institute of the Swiss Federal Technical College.]** *Schweiz. Z. Forstw.* 97, 1946 (94–112). [G.g.f.] [1602].

A review is made of the implications of research on provenance, and stress is laid on the need for measures to provide increased supplies of suitable seed for the conversion of considerable areas of forest not adapted to the site. It is believed that a central seed-supply office would only increase the danger of mixing local races, and that supply organizations should operate in a closely defined natural region. The practical tasks of the newly created Advisory Office are concluded to be: (*a*) education, by means of publications, lectures, courses; (*b*) advice on, initiation of, and possibly co-operation in the creation of local seed-supply organizations; (*c*) advice on and collaboration in the selection of suitable parent stands; (*d*) preparation of directives for nursery work and the control of seeds and plants; (*e*) co-ordination of all efforts in any way related to forest seed questions. Its scientific tasks will be: (*a*) Continuation of provenance trials and initiation of plantation trials, under scientific control, to determine the suitability of economically desirable races for given site conditions; (*b*) initiation of research on hereditary characters of importance to forestry. *From author's summary.* [Cf. *For. Abstr.* 7 (No. 2182).]

12.11.3 (73) : 12.25 : 23.23.1. MINCKLER, L. S. **Seed source—is it taken seriously?** *J. For.* 43, 1945 (749–50). [Appalachian Forest Exp. Sta., Asheville, N.C.] [1603.]

In 1939 the Seed Policy Committee of the U.S. Department of Agriculture published a newly adopted departmental policy covering the procurement of forest tree seed. This emphasized the desirability of using seed collected from natural stands of known locality and within 100 miles distance and 1,000 ft. elevation of the planting site. Data recently collected on the source of Loblolly and Shortleaf Pine seed used in the forest nurseries of 12 states for 1945 seedling distribution indicate lack of substantial progress towards this end. For the two species together, the seed source was definitely known by county, locality, or geographic region of the state in only 6 out of 20 cases. One state went over 900 miles for seed of two species and 700 to 800 miles for a third.

12.11.3 : 12.25 : 31.1 : 56 : 12.14.8 (43.1–5). SCHREIBER, M. Über Unterschiede in der Berindung und Verkernung bei Standortsrassen der europäischen Lärche. **[On differences in bark percentage and heartwood formation in local races of European Larch.]** *Forstwiss. Cbl. u. Thar. Forstl. Jb.* No. 2, 1944 (73–102). [G.] [1604].

The present results are supplementary to those reported in a previous paper [*Cbl. ges. Forstw.* 1940 (9/12)]. The material examined consisted of roughly 25-year-old windthrows of a Sudeten, an East Alpine and two Polish provenances.

(i) *Bark percentage*: In general, Schober's conclusion that the absolute bark thickness is a function of stem diameter, was confirmed. There were, however, clear differences between the provenances in the ratio bark-thickness/increment, e.g. for 1 cm. of wood increment at breast height the average bark increments were: Sudeten 0·51, Alpine 0·54, and Polish 0·68 mm. The corresponding 'mean basal-area bark per cents' and bark in percentage of stem volume (latter in parenthesis) were: Sudeten 20·1 (20·4), Alpine 22·2 (22·0) and Polish 25·1 (25·2) and 26·1 (25·5). Thus the mean bark thickness of Larch depends primarily on its racial origin and secondarily on its increment on a given site. The zone of relatively least bark increment for the mean tree of each provenance was: Alpine (mean height 6 m.) at 2·5 m., Sudeten and one Polish race (mean height 8 m.) at 3·0 m., and the second Polish race (mean height 9 m.) at 3·5 m. (all figures approximate). The Polish provenances showed a more marked increase of bark towards the foot of the stem than either of the others. The results also confirm previous findings that Larch stems have a greater taper over than under bark, the difference again being considerably greater for the Polish than for the remaining two provenances.

(ii) *Heartwood formation*: The mean percentages for heartwood basal area and volume (both under bark; latter in parenthesis) were: Sudeten 38·1 (39·8), Alpine 29·7 (34·4), Polish 27·9 (30·7) and 26·6 (27·0). Since these figures take no account of variations in ring breadth and therefore fail to eliminate the effect of environmental factors, a further calculation was made of the number of sapwood rings in percentage of total number of rings. On this basis the ranking of the provenances was: Sudeten (23-year-old; remaining provenances 25-year-old) 53, Polish 61 and 63, Alpine 68. Some additional results for roughly equally aged old Larches of Sudeten and East Alpine provenances confirmed that the latter had the greater percentage of sapwood rings. It was also noted that in marginal trees exposed to the wind the changes in general stem form were paralleled in that of the heartwood.

12.11.3 : 12.25. LARSEN, N. J. Sitkagran × Hvidgran. **[Sitka Spruce × White Spruce.]** *Dansk Skovforen. Tidsskr.* 30, 1945 (450–1). [Dan.] [1605].

In almost all 7- to 12-year-old Spruce plantations in the author's district, the plants bought from various nurseries as Sitka are mainly Sitka × White Spruce [cf. *For. Abstr.* 7

(No. 1090)]. Many plants closely resemble White Spruce, and this raises the question whether they belong to F_1 or later generations. Most of the plantations were formed with 20–50 per cent. 'Sitka' in mixture with Norway Spruce; everywhere the 'Sitka' hybrids are growing slower than the Norway Spruce, and for the better sites the hybrid must be considered much inferior to pure Sitka. Revision of approved seed stands is necessary to eliminate the possibility of further disseminating the hybrid, and until a fair appraisal of the latter has been made, only pure Sitka, if obtainable, should be planted.

12.11.3 : 12.25 (489). BORNEBUSCH, C. H. Sitka-Hvidgran-Bastarden. [**The Sitka × White Spruce hybrid.**] *Dansk Skovforen. Tidsskr.* 31, 1946 (42–6). [Dan.] [1606].

Sitka × White Spruce hybrids are said to have existed in the Danish Forest Research Organization's nurseries as long ago as the end of the last century, and to have been shorter-branched but not inferior to pure Sitka in growth.

The author's experience of the hybrid does not agree with the serious objections raised by Thaarup and Larsen [see preceding abstract], and he is in strong disagreement with a proposal to use only Sitka seed of American origin. A check was recently made on the progeny of one of the Seed Committee's approved Sitka stands, with results which, while not completely certain, suggest that the few White Spruces in its vicinity give rise to few hybrids. It is believed that there is no real basis for concern about the local production of Sitka seed in large pure stands; but though it is clearly impossible to cut out all the White Spruce and hybrids in existence, it is desirable, in view of the doubtful value of the hybrids, that the chances of cross pollination should be eliminated wherever possible. Danish-grown Sitka seed of the Washington provenance is probably to be preferred to that of the island or more northerly provenances.

12.11.3 : 12.26–8. WOLF, W. ***Quercus capesii* (*Quercus phellos* L. × *Quercus nigra* L.).** *Castanea* 10, 1945 (91). [St. Bernard College, St. Bernard, Ala.] [1607].

Description and account of the origin of a hybrid Oak.

12.11.3 : 12.26–8 : 21.31. BRODBECK. Trocken-Pappeln. [**Dry-ground Poplars.**] *Schweiz. Z. Forstw.* 96, 1945 (129–31). [G.] [1608].

In a park at Bâle several 'Carolina' [hybrid Black?] Poplars were found thriving on a lean, dry gravel soil with a water table apparently deeper than 10 m. below the surface. At 89 years of age the best specimen was about 28 m. high, with a clear bole of 12 m. and a d.b.h. of 131 cm. The bark of the trees is thick and corky. They are believed to represent a marked race, and cuttings have been taken.

12.12. Teratology

12.12 : 12.25. JONEBORG, S. Monströs kottebildning hos granen. Vegetativt skott eller kotte? [**Monstrous cone formation in Spruce. Vegetative shoot or cone?**] *Svenska SkogsvFören. Tidskr.* 43, 1945 (453–62). [Sw.] [1609].

In several localities near Söderköping, monstrous forms with various transitions from cone to shoot structure have been found. They are referred to *Picea abies* f. *acrocona*, but in contrast to Fries's original account, the cone-shoot transitions are common on lateral branches, and monstrous cones are seldom prolonged into a normal vegetative shoot. An increase of normal branches is often associated with the monstrosities. Illustrations are given of some of the many types of irregular branching and of the malformations themselves. The cause of the malformations is not understood: if they are due to some special substance affecting the production of reproductive organs, investigation might be worth while in connexion with genetic work, etc.

12.13. Embryology

12.13 : 12.26–8 : 07.2. MAHESHWARI, P. **Embryology of angiosperms as a field for research.** *Nature, Lond.* 156, 1945 (354–5). [Department of Botany, Univ. of Dacca.] [1610].

A brief review of developments in (1) descriptive embryology (development of the pollen and embryo sac and the processes of fertilization and seed formation), (2) phylogenetic embryology (chiefly comparative embryology and its use in determining plant relationships and taxonomy), and (3) applied and experimental embryology (viability of pollen and optimum conditions for its storage and germination, the receptivity of the stigma, fertilization and fruit setting, and the influence of external conditions on embryo development). Detailed knowledge of the embryology and internal structure of plant families may in some cases change our ideas on their relationships. The culture of excised embryos under aseptic conditions has helped considerably to overcome the sterility inherent in certain interspecific hybrids and may be of great importance to the plant breeder.

12.14. Organography. Morphology. Anatomy. Histology

12.14.1. ITERSON, G. VAN, and MEEUSE, A. D. J. **The shape of cells in homogeneous plant tissues.** *Repr.* from *Proc.* [*Versl.?*] *ned. Akad. Wetenschappen* 44, 1941 (770–8, 897–906). [E.] L.C. [1611].

12.14.1. FREY-WYSSLING, A. Das Streckungswachstum der pflanzlichen Zellen. **[The extension growth of plant cells.]** *Repr.* from *Arch. Klaus-Stift. VererbForsch.* No. 20, 1945 (381–402). [G.] [1612].

With special reference to over-emphasis in the past on the physical and mechanical aspects of growth and quasi-passive cell components, e.g. cell wall and vacuole, and to the correction of such views by recent work showing that cytoplasmic growth and physiological processes in the cytoplasm are intimately concerned.

12.14.1 : 12.14.5 : 12.11.12. LEWIS, F. J. **Physical conditions of the surface of the mesophyll cell walls of the leaf.** *Nature, Lond.* 156, 1945 (407–9). [Fouad I Univ., Cairo.] [1613].

Experiments with leaves of *Ficus elastica* and other species indicate that whereas water placed on the surface of the mesophyll cells shows no disposition to spread over that surface and penetrate the capillary-space system, many organic liquids (such as pure medicinal paraffin) may rapidly enter the intercellular air spaces under similar conditions. While the mesophyll is rapidly passing water vapour into the air, the cellulose walls from which the vapour proceeds cannot be wetted, and no condensation of water occurs on this surface. When oil is applied to the cellulose walls under these conditions, however, it immediately flows over them and fills the capillary space.

Infiltration of the air-space system by dyes (under pressure) indicates that adsorption or non-adsorption depends on the acid or basic character of the chromogen group of the dye. The hydrophobic nature of the surface of the cell wall can be destroyed by sodium taurocholate.

12.14.3. VORONIN, N. S. K voprosu ob evolyutsii peritsikla v kornyakh rasteni. **[On the evolution of the pericycle in plant roots.]** *Bot. Zh. SSSR* 30, 1945 (147–53 + chart). [Russ.e.] O.B.D. [1614].

From a review of root-pericycle types it is concluded that a multi-layered pericycle is a primitive character, reduction in the more advanced groups being regarded as an adaptation to secure readier entry of water into xylem, as is also the segregation of phloem into separate strands. A diagram shows the occurrence of multi-layered root pericycles in relation to Kuznetsov's phylogenetic classification.

12.14.5 : 12.26–8 : 12.11.11 : 34.26. VAROSSIEAU, W. W. **Microscopical anatomy of tropical plants. I. Anatomical and microchemical observations on the leaf of *Palaquium gutta* Burck.** *Repr.* from *Ann. Jard. bot. Buitenz.* 48, 1938 (153–72 + plates). [Laboratory for Technical Botany, Delft.] L.C. [1615].

Gutta occurs in the leaf of *Palaquium gutta* Burck. (1) in the central vacuole of certain cells, chiefly palisade cells and in the guard cells of the stomata, and (2) within the latex vessels. In the parenchyma cells the gutta is present in isotropic droplets or in anisotropic crystals. In dried leaves the cellular gutta occurs exclusively in radially arranged crystallites. The latex vessels of *Palaquium* leaves originate from rows of parenchymatous cells in the meristematic tissues. They are almost absent from the region near the lower surface of the leaf. *From author's summary.*

12.14.8. HOLDHEIDE, W. Rindenanatomische Untersuchungen. **[Investigations on bark anatomy.]** *Abstr.* in *Forstwiss. Cbl. u. Tharforstl. Jb.* No. 1, 1944 (43–5) [G.] [1616].

The original lecture contained a general account of bark structure and a special review of the barks of different species. Only the former is here reproduced in condensed form. Past neglect of the anatomy of the bark as a whole is stressed. A microphotographic atlas of barks was being prepared for publication.

12.19. Geographical Distribution. Plant Geography and Sociology

12.19 (57.1). Sochava, V. B. Prichinȳ bezles'ya gol'tsov vostochnoy Sibiri i v Priamur'e. **[Causes of the treeless condition of mountains of Eastern Siberia and the Amur region.]** *Priroda* 33 (2), 1944 (63–5). [Russ.] C.G.B. [1617].

The question of the cause of the treeless condition of the mountain tundra in north-east Asia has been insufficiently studied, though it has been thought that low temperature and extremely strong winds are responsible in both the polar and mountain tundra types.

Although tree species are encountered in the southern and occasionally in the middle zones of the polar region they are all of vegetative origin, and as a rule no young seedlings are found. Here the causes are to be sought in the permanent subsoil frost, high moisture content, poor drainage, extreme shallowness of the soil proper, and the very high atmospheric humidity, as a result of which neither the soil nor the lower layers of air become sufficiently warm during the growing season. Hence, although seeds are brought by the wind, they seldom germinate, owing both to these conditions and to the rarity of production of viable seed in the arctic forests from which they come. Wind appears to play a secondary part, since in the Anabarsk and Khatangsk tundra, where drainage is better and the soil is more easily warmed, creeping forms of Larch are found growing even in the most windy places.

The mountain tundra in Eastern Siberia and the Amur region is due to a combination of wind and low air temperature, but chiefly to wind. As wind velocity depends both on height and massiveness of the mountains, the mountain-tundra line varies accordingly, e.g. in the Amur region tundra begins on comparatively low mountains at about 1,100 m. and on more massive mountains at 1,400 m. altitude.

The mountain soils are better drained, and permanent subsoil frost is either absent or at too deep a level to affect the surface layers. Even with the smallest protection from wind, growth of tree species becomes possible and seed germinates readily: all the trees found in sheltered places were of seedling and not vegetative origin. Creeping forms of Siberian Pine and Larch produce ripe seed regularly. Dahurian Larch, Ayansk and Siberian Spruces all occur as creeping types. Other partial causes contributing to the treeless condition of mountain tops are barren screes and bare rocks formed by combined wind action and frost crumbling, and on some rocky slopes the presence of lichens forming a mat as much as 30–40 cm. deep which prevents seedling establishment. [Cf. *For. Abstr.* 7 (No. 1651)].

12.19 (72 : 728 : 729 : 8) : 09.7 : 34. Verdoorn, F. (Ed.). **Plants and plant science in Latin America.** Chronica Botanica Company, Waltham, Mass. 1945. pp. xl + 384. Price $6.00. O.B.D. [1618].

A collection of articles by various authors dealing mainly with the vegetation and plant resources of Latin America. Part I (pp. 1–260) consists primarily of papers not previously published, while Part II (pp. 261–349) is made up of papers (mostly somewhat revised) which have already appeared in *Chronica Botanica*.

12.19 (72 : 728 : 729.8). Smith, A. C., and Johnston, I. M. **A phytogeographic sketch of Latin America.** In *Plants and Plant Science in Latin America*. Chronica Botanica Company, Waltham, Mass. 1945. pp. 11–18 + plates. [Arnold Arboretum, Harvard Univ.] O.B.D. [1619].

An introductory summary of the plant geography of Latin America more fully described in subsequent articles, and combining the various detailed maps in a general vegetation map of the area. Both the terminology and the inter-zonal boundaries used are largely a matter of compromise. The major phytogeographic zones are classified under five main headings: (1) forests or wooded regions (including tropical and subtropical rain forest, tropical deciduous forest, South Brazilian forest and savanna zone, palm forest, sub-antarctic Beech forest, and thorn forest); (2) grasslands and savannas; (3) deserts or semi-desert regions; (4) montane zone; and (5) maritime or littoral zone. The main subdivisions of all except the maritime zone are shown in the accompanying map, and the vegetation of each subdivision is briefly discussed in the text.

12.19 (728.3). Yuncker, T. G. **The vegetation of Honduras, a brief review.** In *Plants and Plant Science in Latin America*. Chronica Botanica Company, Waltham, Mass. 1945. pp. 55–6. [De Pauw Univ., Greencastle, Ind.] O.B.D. [1620].

About 500 species of trees are recorded from Honduras, the large flora of which is rich in endemics. The plants of the coastal plain are predominantly those found throughout Central America in similar situations from South America to Mexico, and the forests of the interior contain common Central American species.

Rhizophora mangle swamps occur along the coast, lagoons and inland streams. In the plains and adjacent mountain slopes are many woody genera, a list of which is given. The middle and upland forests contain palms (*Chamaedorea*, and *Orbignya cohune*). Mountain forests of the interior are mostly virgin and unexplored botanically. Where the rainfall is less and on the leeward slopes of the northern range open park-like regions with Pine and Oak forests predominate (*Pinus oocarpa* and *P. pseudostrobus*). Above the Pine/Oak zone the highest peaks are covered with upland deciduous forest. In the Aguan river valley is a semi-arid region with *Opuntia hondurensis* and *Cereus yunckeri*; the species associated with these giant cacti are listed.

12.19 (728.4). KOVAR, P. A. Idea general de la vegetación de El Salvador. **[General idea of the vegetation of El Salvador.]** In *Plants and Plant Science in Latin America*. Chronica Botanica Company, Waltham, Mass. 1945. pp. 56–5. [Span.] [Centro Nacional de Agronomia, San Salvador.] O.B.D. [1621].

The dense population of El Salvador and the local systems of agriculture have almost completely destroyed the original vegetation. Coastal districts, periodically invaded by the sea, still contain Mangroves (*Rhizophora mangle*, *Avicennia bicolor*, *A. nitida*, *Conocarpus erecta*, *Laguncularia racemosa*), *Hippomane* and *Capparis*. Further inland are the deciduous selvas.

The author gives brief lists of the more important plants in each of the vegetational zones.

12.19 (728.6). STANDLEY, P. C. **A brief survey of the vegetation of Costa Rica.** In *Plants and Plant Science in Latin America*. Chronica Botanica Company, Waltham, Mass. 1945. pp. 64–7. [Chicago Natural History Museum, Chicago, Ill.] O.B.D. [1622].

The author divides the vegetation of Costa Rica into three main zones (based upon rainfall and elevation): (1) The Atlantic *tierra caliente*; (2) the temperate region (*tierra templada*); and (3) the cold region (*tierra fria*). The first region comprises the unbroken rain forest of the Caribbean lowlands between sea level and 800–1,000 m. The temperate zone (in which coffee is planted) includes most of the uplands, with the exception of the mountain summits. The natural vegetation is dense Oak (*Quercus* spp.) forest. The cold region comprises all mountain slopes above about 1,500 m. Many of the plants of this region are local in distribution. The genus best represented by species and individuals is *Quercus*. Among the other characteristic genera of the cold region are *Podocarpus*, *Weinmannia*, *Blakea*, *Topobea Prunus*, *Drimys*, *Brunellia*, *Sambucus* and *Billia*. Large areas of the *tierra fria* have been cleared for cattle pastures.

12.19 (729.1). CARABIA, J. P. **A brief review of the Cuban flora.** In *Plants and Plant Science of Latin America.* Chronica Botanica Company, Waltham, Mass. 1945. pp. 68–70. [New York Botanical Garden, New York City.] O.B.D. [1623].

The natural vegetation of Cuba may be divided into six major floristic groups: (1) coastal and shore vegetation; (2) savannas; (3) the tropical forests of the Oriente and Santa Clara hills; (4) the blue limestone hills of Pinar del Rio; (5) swamp and lagoon vegetation; and (6) the siliceous savannas of Pinar del Rio and Isle of Pines. Each of these vegetational groups is briefly discussed and their principal plant species are listed. The flora shows a very high percentage of endemism and contains nearly 8,000 known species of vascular plants.

12.19 (729.2) : 12.26–8 : 11.49 : 12.14. CHAPMAN, V. J. **1939 Cambridge University expedition to Jamaica. Part 1. A study of the botanical processes concerned in the development of the Jamaican shoreline. Part 2. A study of the environment of *Avicennia nitida* Jacq. in Jamaica. Part 3. The morphology of *Avicennia nitida* Jacq. and the function of its pneumatophores.** *Extr.* from *J. Linn. Soc.* (*Bot.*) 52, 1944 (407–533 + plates). [1624].

In the summer of 1939 an expedition left Cambridge University with the primary object of making a detailed study of the physiographical, botanical and zoological processes which are associated in the development of the West Indian shore-line. In spite of the outbreak of war, practically the whole programme was completed, but publication of a number of reports has been delayed. The contents of the present report are as follows:

(1) Introduction, climate and tides; strand and dune vegetation; Mangrove vegetation (ecological classification, habitat classification, systematics, distribution and establishment, factors controlling distribution, Mangrove types, succession, geologic work of Mangroves).

(2) Environment of *Avicennia nitida*: climate; tides and associated phenomena; accretion; soils; water table and drainage; aeration; sodium and chlorine in adult plants; sodium and chlorine in seedlings.

(3) Morphology of *Avicennia nitida*: development of the seedling; cotyledons; leaves and leaf traces; hypocotyl and stem; roots; functions of pneumatophores (gaseous interchange, absorbing roots, respiration).

12.19 (729.2) : 34. LARTER, L. N. H. **Plant resources of Jamaica.** In *Plants and Plant Science in Latin America.* Chronica Botanica Company, Waltham, Mass. 1945. pp. 73–6. [Department of Science and Agriculture, Kingston, Jamaica.] O.B.D. [1625].

The orientation and topography of Jamaica have a profound effect on rainfall distribution, which is the determining factor in the floristic composition of the several ecological areas. There are three main vegetational zones: (1) The north-east section of the island from the coast to the crests of the Blue Mountain, with an average rainfall of 100 to 200 in.; (2) the Central Plateau, with a rainfall of 70 to 90 in., rising to 100 in. in restricted areas; and (3) the Southern Coastal Plain and part of the north-west section of the island, with a rainfall of less than 50 in.

The mountainous areas are cut by numerous deep river valleys, and the mountain slopes have suffered considerably from deforestation and erosion, hence it is only on the less accessible ridges that the tropical rain forest still occurs. The higher slopes of the Blue Mountain region are heavily wooded, however, and support a rich undergrowth, but the soil is shallow, and tall trees are the exception. The flora is rich in species but contains few dominants.

The Central Plateau carries, on its northern side and higher parts, thickly wooded areas from which the bulk of the native timber is obtained. At lower elevations park land and pasture typify the ecotype.

The Southern Coastal Plain is clothed with grassland and xeromorphic scrub. In the coast itself Salina and Mangrove swamp are common. The coastal areas of the north-west have a similar vegetation.

Sugarcane has now replaced bananas as the most important economic crop of Jamaica. Other plant products include Lignum Vitae (*Guaiacum officinale*), Quassia chips and Bitterwood logs (*Picraena excelsa*), Divi-Divi (*Caesalpinia coriaria*), Satinwood (*Xanthoxylum flavum*), and Fustic (*Chlorophora tinctoria*). Small quantities of Lignum Vitae, Mahogany (*Swietenia mahagoni*), Satinwood, and Sandal (*Amyris balsamifera*) are exported. Lists are given of the most important timber species obtained from each of the three main ecological zones.

12.19 (729.3 : 729.4). HOLDRIDGE, L. R. **A brief sketch of the flora of Hispaniola.** In *Plants and Plant Science in Latin America.* Chronica Botanica Company, Waltham, Mass. 1945. pp. 76–8. [Forestry Division, Port-au-Prince, Haiti.] O.B.D. [1626].

The island of Hispaniola consists of two republics—Haiti, with a dense rural population and only scattered remnants of the original vegetation, and the Dominican Republic, with a surprisingly low population and vast areas of apparently virgin forest even in the lowlands. The three major types of natural vegetation in Hispaniola are (i) the dry forest of the lowlands; (ii) the moist forest, which comes down close to sea level in north-eastern Hispaniola but is forced to a higher elevation in the sections of the island which receive a smaller rainfall at sea level; and (iii) the Pine forest, composed mainly of *Pinus occidentalis.* Mangrove swamps form a smaller but distinct type, especially along the north coast. The main plant species are indicated for each vegetational type. Important timber trees of the dry lowland forest are *Swietenia mahagoni*, *Guaiacum officinale*, *G. sanctum*, *Lysiloma latisiliqua*, *Cordia alliodora*, *Krugiodendrum ferreum*, *Acacia scleroxyla*, *Colubrina ferruginea*, *Petitia domingensis*, and *Phyllostylon brasiliensis.*

12.19 (729.5). HOLDRIDGE, L. R. **A brief sketch of the Puerto Rican flora.** In *Plants and Plant Science in Latin America.*

Chronica Botanica Company, Waltham, Mass. 1945. pp. 81–3. [Forestry Division, Port-au-Prince, Haiti.] O.B.D. [1627].

Owing to the introduction of numerous exotic species into Puerto Rico it is difficult to divide the island into true forest types or plant associations. Seven vegetational types are recognized on the accompanying map: (1) wet high mountain; (2) moist mountain; (3) moist lowland; (4) moist limestone; (5) serpentine; (6) Mangrove swamp; and (7) dry lowland. The moist lowland type, in particular, has been completely altered by the hand of man.

12.19 (729.6) : 31.0 : 09.7. Stehlé, H. Les conditions écologiques, la végétation et les ressources agricoles de l'Archipel des Petites Antilles. **[Ecological conditions, vegetation and agricultural resources of the Lesser Antilles Archipelago.]** In *Plants and Plant Science in Latin America*. Chronica Botanica Company, Waltham, Mass. 1945. pp. 85–100. [F.] O.B.D. [1628].

A paper dealing with the geography of the Lesser Antilles, ecological conditions, geological history and edaphic conditions, and (more fully) with the types of natural vegetation. Five forest types are distinguished and discussed: (1) Mangrove forest; (2) xerophytic or xero-heliophilous forest; (3) mesophytic or intermediary forest; (4) hygrophytic or hygro-sciaphilous forest; and (5) high forest. After a short review of the wealth of species, endemism, floristic-geographical affinities, and plant succession and associations, the author discusses the regressive evolution of the Caribbean flora and the economic plant resources of the region. The principal forest species are listed. They include *Swietenia macrophylla*, and *S. mahagoni*. Some reforestation has been carried out with these two Mahoganies, as well as with exotics such as *Tectona grandis*, *Cassia siamea* and various Eucalypts.

12.19 (729.7). Beard, J. S. P. **A brief review of the vegetation of Trinidad and Tobago.** In *Plants and Plant Science in Latin America*. Chronica Botanica Company, Waltham, Mass. 1945. pp. 100–1. [Forestry Department, Port of Spain, Trinidad.] O.B.D. [1629].

The flora of Trinidad and Tobago, comprising approximately 2,200 species of Phanerogams, is predominantly South American rather than Caribbean in character, although there are found in Tobago a number of Caribbean species which do not extend as far south as Trinidad. The proportion of endemic species has been estimated at 7 per cent. At the present time about 46 per cent. of the two islands is still under natural vegetation. The plant associations of Tobago have not been studied in detail, but the littoral types are the same as those of Trinidad and the major inland type appears to be evergreen rain forest. The following major vegetation types can be distinguished in Trinidad: (1) Evergreen semi-monsoon forest; (2) *Mora excelsa* forest; (3) lower montane evergreen rain forest; (4) montane rain forest; (5) elfin woodland; (6) semi-evergreen, semi-monsoon forest; (7) the 50-per-cent. deciduous forest of the north-west peninsula and adjoining islands; (8) the littoral vegetation of the windward coast; (9) marsh vegetation; (10) herbaceous swamp; (11) Mangrove swamp; and (12) cultivated lands.

The characteristic species of each zone are indicated.

12.19 (81) : 09.1 : 92. Souza, P. F. **The Brazilian forests.** In *Plants and Plant Science in Latin America*. Chronica Botanica Company, Waltham, Mass. 1945. pp. 111–9. [Serviço Florestal, Rio de Janeiro.] O.B.D. [1630].

After a brief review of forest exploitation and legislation in Brazil from the sixteenth century onwards, the author discusses the flora of the country under two major headings: (1) the Amazonian flora; and (2) the general flora of Brazil or extra-Amazonian flora. The Amazonian flora is subdivided into three forest types characterized by the hydrographic system to which they belong: (1) sea-inundated forests; (2) bottomland forests subject to annual flooding: and (3) upland forests. The extra-Amazonian flora consists of six zones. (1) The Palm zone of the middle north; (2) the 'caatingas' of the north-east; (3) the coast forests or oriental forests; (4) the zone of the Pine forests; (5) the prairies; and (6) the maritime zone. The characteristic vegetation of each zone is briefly indicated.

A resumé is given of the Brazilian Forest Code approved in 1934, incorporating all measures deemed necessary for the rational exploitation of Brazilian forests. At present, various States and the Central Government take care of their forests by means of specialized services.

12.19 (81). Smith, L. B. **The vegetation of Brazil.** In *Plants and Plant Science in Latin America.* Chronica Botanica Company, Waltham, Mass. 1945. pp. 297–302. [Gray Herbarium, Harvard Univ.] O.B.D. [1631].

Two major phytogeographical regions are distinguished: (1) the Amazon Basin or Hylaea and (2) the extra-Amazonian or 'generalized' area. The flora of the river basin is remarkably uniform, in contrast to the diversity of the 'flora geral' of the plateau area of Brazil. The dominant species change from one part of the Amazon to the other, but they have much the same environment and follow the same pattern of succession. The governing factors are the even, high temperature, the heavy rainfall and the alluvial soil. The jungle, which is the dominant Amazonian cover is divisible into three general ecological types according to the water available; (1) the upland jungle, characterized by *Bertholletia excelsa*; (2) the floodplain jungle in which *Hevea brasiliensis* is the characteristic species; and (3) the continuously inundated jungle.

The flora of the plateau is exceedingly diverse, but the predominant type is the sub-arid plain or campo. There are six major zones: (1) the Palm (*Orbignya martiana*) forests or 'zone of cacaos'; (2) the caatinga zone (basically open scrub forest); (3) the coastal rain-forest; (4) the Paraná Pine (*Araucaria angustifolia*) zone; (5) the extensive prairies or campos; (6) the maritime zone. The characteristic vegetation of each of these zones is briefly described.

12.19 (82) : 33 : 34. Parodi, L. R. Las regiones fitogeográficas Argentinas y sus relaciones con la industria forestal. **[The phytogeographical regions of Argentina and their relation to the forest industry.]** In *Plants and Plant Science in Latin America.* Chronica Botanica Company, Waltham, Mass. 1945. pp. 127–32. [Span.] [Univ. de Buenos Aires.] O.B.D. [1632].

About one-third of the total area of Argentina is covered with forests yielding timber species. The phytogeographic regions of the country are as follows: (1) *selva misionera* (rain forest); (2) *selva* of the subtropical Tucuman-Bolivian mountains (mountain forest;) (3) *parque chaqueño* (transition from closed forest to parkland); (4) *bosque pampeano* (open woodland); (5) *parque mesopotámico* (marginal forest and parkland); (6) sub-antarctic forests; (7) pampean steppe; (8) the xerophilous western mountain vegetation; (9) Patagonian steppe or semi-desert; and (10) Andean desert. Each phytogeographic region is described briefly. Among the valuable indigenous timber species noted are *Tecoma ipe*, *Cedrela fissilis*, *Patagonula americana*, *Astronium balansae*, *Enterolobium contortisiliquum*, *Apuleia leiocarpa*, *Pterogyne nitens* and *Araucaria angustifolia* from the rain forest; *Prosopis caldenia* from the *bosque pampeano; Prosopis ñandubay*, *Piptadenia* sp., *Astronium balansae*, *Salix humboldtiana*, *Celtis spinosa*, *Tecoma ipe* and *Peltophorum dubium* from the *parque mespotámico;* and *Nothofagus* spp., *Libocedrus chilensis*, *Araucaria araucana*, *Fitzroya cupressoides* and *Lomatia obliqua* from the sub-antarctic forests.

Although trees do not occur naturally on the pampean steppe, afforestation has been carried out successfully with the following species: *Eucalyptus globulus*, *E. viminalis*, *Melia azedarach*, *Casuarina cunninghamiana*, *Platanus acerifolia*, *Salix babylonica*, *Populus* spp., *Robinia pseudoacacia*, *Gleditsia triacanthos*, *Ulmus campestris*, *Pinus* spp., *Quercus* spp., *Ailanthus altissima* and *Fraxinus* sp.

12.19 (83) : 09.7. Goodspeed, T. H. **Notes on the vegetation and plant resources of Chile.** In *Plants and Plant Science in Latin America.* Chronica Botanica Company, Waltham, Mass. 1945. pp. 145–9. [Univ. of California, Berkeley, Calif.] O.B.D. [1633].

Three main geobotanical zones are distinguished: (1) an essentially rainless area between latitude 19° and 30° 50′; (2) a Mediterranean area between 30° 50′ and 37°; and (3) a humid area between Concepción and Tierra del Fuego (37°–56°), which is heavily forested. There is, in addition, the Alpine vegetation of the Andean highlands. The characteristic vegetation of each zone is briefly described.

In the third geobotanical zone large areas are covered with sometimes almost impenetrable rain forest, the principal component of which is False Beech (*Nothofagus* spp.). Nine coniferous species are reported from the Chilean forests: *Saxegothea conspicua*, *Pilgerodendron uviferum*, *Dacrydium fonckii*, *Podocarpus nubigenus*, *P. salignus*, *P. andinus*, *Fitzroya cupressoides*, *Libocedrus chilensis*, and *Araucaria araucana*, and trees of the Myrtaceae are often conspicuous elements.

Among the species cut, in order of their commercial importance, are: *Nothofagus procera*, *N. obliqua*, *N. betuloides*, *Laurelia aromatica*, *Araucaria araucana*, *Podocarpus nubigenus*, *P. salignus*, *Pilgerodendron uviferum*, *Libocedrus chilensis*, *Persea lingue*, and *Fitzroya cupressoides*. The last-named is renowned for the quality and size of its timber. *Eucalyptus* and Poplar have long been grown to a limited extent, and cultivation of the former is increasing in appropriate climates.

It is believed that Chile's forest resources can play an important part in her internal economy, and the United States Forest Service is to make a survey of the nature and extent of Chilean forests, studies of logging methods and costs, and of timber species of potential commercial importance.

12.19 (83) : 09.7. SKOTTSBERG, G. **The Juan Fernandez and Desventuradas Islands.** In *Plants and Plant Science in Latin America*. 1945. pp. 151–3. [Botaniska Trädgården, Göteborg, Sweden.] O.B.D. [1634].

The Juan Fernandez archipelago includes 3 islands: Masatierra, Santa Clara (a small islet), and Masafuera. The humid sections of Masatierra were formerly densely forested, but the outer part of the valley floors and the lower slopes are now destitute of forest. The indigenous vegetation is evergreen, subtropical-temperate forest composed mainly of *Myrceugenia fernandeziana*, as a rule accompanied by *Fagara mayu*, an endemic variety of *Drimys winteri*, and *Sophora fernandeziana*. The flora of the montane forest, above some 350–400 m., is more varied and contains several additional tree species.

In Masafuera the closed forest is confined to a belt between approximately 300 and 700 m. It is of the same general type as in Masatierra but drier, and formed by *Myrceugenia schulzei* as dominant, mixed with *Drimys*, *Coprosma pyrifolia*, *Rhaphithamnus* and *Fagara externa*.

The known flora of the Desventuradas is limited to 19 phanerogams belonging to 16 genera and 13 families. Three of the genera are endemic—*Nesocaryum*, *Lycapsus*, and *Thamnoseris*. The last-named genus consists of dwarf rosette trees.

12.19 (86). SVENSON, H. K. **A brief review of the Galapagos flora.** In *Plants and Plant Science in Latin America*. Chronica Botanica Company, Waltham, Mass. 1945. pp. 149–50. [Brooklyn Botanical Garden, Brooklyn, N.Y.] O.B.D. [1635].

Halophytic shrubs and trees such as *Rhizophora mangle*, *Conocarpus erectus* and *Avicennia nitida* are found in places along the coasts, while further inland the coastal thickets give way on the lower slopes to xerophytic forest composed of large trees of *Pisonia floribunda*, *Psidium galapageium*, *Xanthoxylum fagara* and *Piscidia erythrina*. On Indefatigable Island plantations have been cut out at the upper edge of the forest zone.

12.19 (87). PITTIER, H., and WILLIAMS, L. **A review of the flora of Venezuela.** In *Plants and Plant Science in Latin America*. Chronica Botanica Company, Waltham, Mass. 1945. pp. 103–5. [Servicio Botánica, Ministerio de Agricultura y Cría, Caracas, Venezuela.] O.B.D. [1636].

The flora of Venezuela is essentially tropical in the lower altitudes and formed mainly of austral and boreal elements at higher levels. The natural vegetation consists of xerophilous forests, temperate forests, paramos, monsoon forests, rain forests and savannas. Topographically and floristically the country may be divided into 4 major natural regions: (1) the coast range; (2) the Andes; (3) the llanos; and (4) the guayana. The general character and vegetation of each region is described briefly.

12.19 (88). GEIJSKES, D. C. **Plants of the Surinam coastland: some observations on the littoral vegetation of Dutch Guiana.** *J. N.Y. bot. Gdn.* 46, 1945 (229–36). [1637].

The flora, fauna and soil types of the Surinam (Dutch Guiana) coastal belt generally differ from those of the interior of the country. The author briefly reviews the main types of vegetation found in the treeless swamps, and on the densely forested sand reefs of the coastal area. Two characteristic species (found also in the interior) are the Silk-cotton or Kapok tree (*Ceiba pentandra*), and Balata (*Manilkara bidentata*). The Poison-tree (*Hura crepitans*) does not occur in the interior but is confined to sandy soil in low-lying brackish-water swamps.

The author emphasizes the value of indicator plants in prospecting large areas for cultivation, afforestation, or irrigation. Provided that the ecological requirements of the characteristic plant species are accurately known, the type of vegetation found in a specific area can give a much better notion of the environment in its extreme and average phases than is possible by means of a sample taken at a certain spot at a certain time.

12.19 (88) : 06.4. MAGUIRE, B. **The first botanical exploration of Table Mountain in Surinam. A report of the New York Botanical Garden's tropical expedition of 1944.** *J. N.Y. bot. Gdn.* 46, 1945 (253–72, 277–87). [1638].

12.19 (89). ROJAS, T., and CARABIA, J. P. Breve reseña de la vegetación Paraguaya. **[Brief review of the vegetation of Paraguay.]** In *Plants and Plant Science in Latin America.* Chronica Botanica Company, Waltham, Mass. 1945. pp. 121–5. [Span.] [Jardin Botánico, Asunción, Paraguay.] O.B.D. [1639].

Six major plant associations are distinguished: (1) the association of the El Chaco region and the other savannas; (2) the halophytic association; (3) the vegetation on and alongside rivers and lagoons; (4) the moist tropical forests of the mountains; (5) the subtropical mountain forests; and (6) the xerophytic vegetation. The characteristic species of each vegetational type are indicated, and a list is given, under families, of the plant species occurring most frequently in Paraguay.

12.19 (89). GURVICH, B. R. La vegetación del Uruguay. **[The vegetation of Uruguay.]** In *Plants and Plant Science in Latin Americs.* Chronica Botanica Company, Waltham, Mass. 1945. pp. 142–3. [Span.] [Facultad de Agronomía, Montevideo.] O.B.D. [1640].

The most important plant formations of Uruguay are: (1) the prairie; (2) the woodlands (*bosquecillos*); (3) the flooded areas in the neighbourhood of rivers and lagoons; (4) the sierras; (5) the coastal sands; and (6) the Palm groves. The woodlands cover only a limited area of the country and do not meet the present demands for timber. Exotic species are under cultivation for industrial purposes, and all furniture woods are imported. Four types of woodland are briefly described: riparian, savanna, mountain, and maritime. [A revision of the earlier article in *Chron. bot.* 6, 1941 (410–1).]

12.19 : 12.25 (43.1–5). REINHOLD, F. Erwiderung auf: 'Zu den natürlichen Verbreitungsgrenzen von Kiefer, Fichte und Tanne im nördlichen Sachsen, von Professor Dr. Alfred Dengler'. **[Reply to the paper: 'On the natural distributional limits of Pine, Spruce and Fir in northern Saxony, by Professor Alfred Dengler'** (with conclusions by Dr. Dengler).] *Forstwiss. Cbl. u. Thar. forstl. Jb.* No. 2, 1944 (126–31). [G.] [1641].

12.19 : 12.26–8 (75.3 : 75.4 : 75.5). ALLHARD, H. A. ***Fraxinus nigra* in the District of Columbia area and in Virginia.** *Castanea* 10, 1945 (82–7). [1642].

The writer discusses reports of the occurrence of *Fraxinus nigra* and concludes that there is no authentic evidence of it in the District of Columbia, but that it may possibly occur in the higher, colder, mountain areas of Virginia. There is ample evidence of its occurrence in West Virginia.

12.19.1. *Regional Floras, including Check Lists*

12.19.1 (73 : 71) : 3 : 13.2. HARLOW, W. M. **Trees of the Eastern United States and Canada.** Whittlesey House, McGraw-Hill Book Company, Inc., New York and London. 1942. pp. xiii + 288 + plates. Price 15*s.* [New York State College of Forestry.] [1643].

A well illustrated little book, written in untechnical language, to enable the amateur to recognize species. Notes are also given on utilization and the relation with wild life.

12.19.1 (77.3). JONES, G. N. **Flora of Illinois.** University of Notre Dame, Notre Dame, Ind. 1945. pp. [vi] + 318. *Monogr. Amer. Midl. Nat.* No. 2. [1644].

12.19.2. *Forest Types*

12.19.2 (43.1–5) : 12.25 : 12.26–8 : 21.0 : 12.11.14. ZENTGRAF, E. Die Entmischung des Buchenwaldes. **[Transition of Beech/Fir to pure Beech forest.]** *Allg. Forst- u. Jagdztg.* 120, 1944 (66–9). [G.] [1645].

A review of literature in connexion with the recession of Silver Fir from Beech/Silver Fir forest at altitudes of 1,000 m. upwards in the Vosges and somewhat higher in the Schwarzwald. The author agrees with Issler [*Vegetationskunde der Vogesen.* Jena, 1942] that the phenomenon is due to low temperature and high atmospheric humidity, which inhibits the transpiration of Silver Fir much more than it does that of Beech. [Cf. also *For. Abstr.* 7 (No. 1111).]

12.19.2 (43.8 : 47). Rubner, K. Das Waldbild des europäischen Ostraums. **[The forests of eastern Europe.]** *Abstr.* in *Forstwiss. Cbl. u. Thar. forstl. Jb.* No. 1, 1944 (32–4). [G] [1646].

A sketch of the major climatic zones and forest regions of the area, with some account of the subdivisions of the three regions—northern European coniferous forest with Birch, north-eastern European mixed conifer/hardwood forest, and eastern European Oak and forest-steppe regions. [Cf. *For. Abstr.* 5 (231).]

12.19.2 (47.0) : 09.2. Vasil'ev, V. N. Neskol'ko slov k voprosu o proiskhozhdenii taygi. **[A note on the question of the origin of the taiga.]** *Priroda* 33 (3), 1944 (71–2). [Russ.] [1647]. L.S.

A. I. Tolmachev's theory that coenoses of the taiga (northern coniferous forest) type occurred in Tertiary times on the mountains, and successively invaded the contemporaneous broadleaved forests of the plains by downward and westward migration as the climate deteriorated, is severely criticized. The evidence, and particularly the close relationship between the component species of the taiga, in spite of their wide geographical distribution, supports the older view that as climate changed, the taiga moved gradually southward to the present zone.

12.19.2 (47.3). Grozdov, B. V. O Bryanskoy botanicheskoy 'anomalii'. **[On the Bryansk botanical 'anomaly'.]** *Bot. Zh. SSSR* 30, 1945 (178–84). [Russ.] O.B.D. [1648].

The Kozelsk-Bryansk region is floristically and ecologically anomalous. It represents a transition between the true forest zone and forest steppe, having coniferous, broadleaved and mixed forests, and including areas that appear never to have been covered by ice even in the most severe glacial periods.

The present forest is supposed to have been built up during the Quaternary period. It is notable for the considerable variety of forest types (up to 86), some of them storeyed, e.g. *Pineto-piceetum corylosum*, *Piceetum quercetosum* and *Alneto-fraxinetum*. Some phytocoenoses contain as many as 50 species.

The ecological relationships of the species are peculiar. For instance, though Spruce has advantages over Oak because of its greater shade tolerance, smaller demands on the soil, and ability to create conditions unfavourable for Oak, it is nevertheless replaced locally by the latter, especially on deep rich soils, in drought localities, under human influence (e.g. clear fellings), and by failure to regenerate where certain types of broadleaved litter prevent the rooting of seedlings. Fire largely determines the relationship of Spruce and Pine, hence in the drier types (*Pinetum vacciniosum*) there is little Spruce; absence of fire and good, moist soils favour Spruce. Pine is one of the most widespread species but is occasionally supplanted by Oak after fellings. Ash replaces Oak after clear felling. Lime forms small pure stands or occurs in the understorey and underwood in both coniferous and broadleaved forests. Birch and Aspen usually occur in temporary successional types after clear felling. Some broadleaved species form special types, e.g. *Betula pubescens* in *Betuletum thelypteriosum*; near Sevsk the peculiar *Quercetum frangulosum* occurs.

Relict species include *Ulmus celtidea*, and some endemics, especially those of chalky slopes, e.g. *Pinus sylvestris* v. *cretacea*.

Intraspecific variations are numerous. In Spruce (*Picea abies*) the red- and green-coned varieties (v. *erythrocarpa* and v. *chlorocarpa*), smooth- and rough-barked types, different habit types, and the cone types v. *medioxima* and v. *acuminata* occur. Pine varieties include habit types e.g. v. *pyramidalis* and v. *cretacea*, and others such as v. *erythranthera*, v. *argentea*, and bark varieties. In Birch there are hybrid races (*B. pubescens* v. *rhombifolia*) and the variety *erythranthera*. *Populus tremula* has the varieties *villosa* and *longistipulosa*. *Quercus robur* includes the varieties *fastigiata*, *brevipes*, *longipedunculata*, *praecox* and *tardiflora*. Phenological races were observed in Aspen, *Prunus padus*, Elm, Birch and other species. Ash has calcophile, hydrophile and mesophytic races.

Unusual features noted were: root-suckering of Common Alder, layering of Pedunculate Oak in *Pinetum vacciniosum* and *P. moliniosum*, and the ability of Spruce, by rapid adjustment to changed light conditions, to form valuable stands from second-storey trees or advance growth.

In mixed stands, Spruce and Norway Maple appear to have a favourable effect on the growth of Pine, and an admixture of Siberian Larch with Ash increased the growing stock by 10–40 per cent. compared with pure Ash stands.

At 80 years of age the growing stock (in cu.m.

per ha.) and mean height (in m., quoted in parenthesis) for some of the forest types on site qualities I and Ia were: *Pinetum coryloso-pulmonariosum* 620 (29·5); *P. coryloso-oxalidosum* 675 (31·5); *P. quercetosum* 715 (31·5); *Piceetum coryloso-pulmonariosum* 650 (29); *Piceetum tilieto-pulmonariosum* 700 (28); *Quercetum tilieto-aegopodiosum* 400 (24).

The average seed yield of Pine in *Pinetum vacciniosum* is 2·02 kg. per ha.; based on this figure the percentage seed yields are 107 for *P. moliniosum*, 85 for *P. myrtillosum* and 19 for *P. tiliosum*.

Notes are included on *Euonymus verrucosus*, which appears to be capable of high yields of gutta percha.

The wide variability of species in the area suggests that valuable types should be investigated for breeding purposes; in this connexion, special mention is made of broad-crowned and rough-barked Pines; green-coned Spruces with the comb type of branching; cylindrical-stemmed Birch; large-coned Siberian Larch; and a high-yielding type of *Euonymus verrucosus*.

12.19.2 (494) : 12.25. Koch, W. Die pflanzengeographische und soziologische Stellung der Föhre (*Pinus sylvestris* L.) in der Schweiz. **[The phytogeographical and ecological position of *Pinus sylvestris* in Switzerland.]** *Schweiz. Z. Forstw.* 97, 1946 (77–94). [G.g.f.] [Institut für spezielle Botanik der Eidg. Technischen Hochschule, Zürich.] [1649].

The first part of this lecture outlines the development of the Euro-Siberian/N. American floristic group and especially the migration and spread of *Pinus sylvestris* into Central Europe during the early post-glacial period, and the origin of its geographical races by selection combined with geographical isolation due to later climatic change. It is an important but difficult task of future silviculture to breed from such local types pure strains of economic value, suited to various sites.

The second part deals with the main Pine regions and sites of Switzerland and the Pine associations hitherto described: most of the natural Pine forests are relict stands, and though Pine forest occasionally occurs as a pioneer, e.g. on the drying gravelly alluvia along rivers, such stands are usually soon replaced by other forest associations. Some natural Pine also occurs as a scattered component of various hardwood associations. On silvicultural grounds, experience has shown that all the relict forests should be carefully preserved, and this for purely practical reasons as well as for scientific study and nature protection. Introduction of any foreign species is disadvantageous, and intervention should be limited to proper tending and efforts to replace inferior by superior races of Pine. The restoration of Pine woods or groups on rocky ridges and hilltops in the midland plateau is desirable in order to improve the landscape, though of minor importance as a forestry measure. The growing of Pine in the hardwood regions raises problems whose solution must come from ecological studies. *From author's summary.*

12.19.2 (494). Kuster, A. Die Waldvegetation in Puschlav. **[The forest vegetation of the Puschlav valley.]** *Schweiz. Z. Forstw.* 96, 1945 (1–12). [G.] [1650].

Brief descriptive notes on the chief features of the forest vegetation. The principal type is Spruce/Larch, between 1,300 and 2,000 m. on both sides of the valley, with Spruce predominating on the less sunny exposures and Larch increasing with increasing altitude, especially on sunny slopes, until at the tree line it is the dominant. Larch occurs as low as 800 and as high as 2,300 m., whereas Spruce is almost confined to the 1,300–2,000 m. zone. Forest quickly recolonizes pastures in this type, and controlled grazing is in the interests of both forestry and pasture management. Cembran Pine occurs in almost pure stands, with some Larch, between 1,800 and 2,250 m. in the Val di Campo, and sporadically elsewhere. Scots Pine is practically confined to the lower half of the valley below the valley block at Meschino, where it is a frequent associate of Larch and Spruce from 800 to 2,000 m., forming pure stands locally below 1,500 m. on warm, dry, rocky slopes. Some broadleaved stands occur in the lower valley: the chief species is *Quercus sessiliflora*, frequent on better sites at 900–1,000 m. altitude between Brusio and Viano. *Tilia cordata*, Birch, Aspen and *Sorbus aria* also occur, and Spanish Chestnut has become naturalized up to 1,000 m. Scrub communities are represented above the tree line by practically pure stands of *Pinus mugo* var. *pumilio*. Green Alder [*Alnus viridis*] scrub occurs at 1,500–2,000 m. on avalanche sites, etc., but is quickly re-invaded by the natural forest. Grey Alder [*A. incana*] scrub lines streams on the valley floor. Hazel scrub occurs on steep, dry, southern slopes and is probably perpetuated by human influence, particularly grazing. The absence of natural Beech, and the failure of introduced Beech, in the valley is attributed to the desiccating effect of the north Föhn, especially in the spring.

12.19.2 (57.1) : 12.19.3. SOCHAVA, V. B. Elementy rastitel'nogo pokrova severnogo Sikhote-Alinya i ikh vzaimootnosheniya. **[Elements of the vegational cover of northern Sikhote-Alin' and their mutual relationships.]** *Sovetsk. Bot.* 13 (1), 1945 (14–32). [Russ.] O.B.D. [1651].

The region described consists of the upper and middle Tumnin basin and the watershed between these and the Silasu, a tributary of the Amur. The main features of relief and their major vegetation types are: (i) The broad Tumnin valley and low hills, for the most part covered with Larch forest; (ii) steep mountain slopes to an altitude of 1,100–1,200 m., and a low terrace of ancient alluvial deposits, with 'dark-needled' coniferous forests, which are regarded as more characteristic though less common than the Larch forests which also exist on the mountain slopes; (iii) mountain tops, with formations of the mountain-tundra complex, which is always separated from the forest by a zone of *Pinus pumila*.

The 'dark-needled' coniferous forest now occupies no large area. It is represented by the following groups of associations: (*a*) With ferns in the field layer, occurring on the second river terrace on weakly podzolized soils rarely reached by floods, consisting of *Picea jezoensis*, *P. koraiensis* and *Abies nephrolepis*, commonly in equal mixture, with some Birch, *Alnus hirsuta*, *Prunus maackii*, *Populus suaveolens*, and on the Amur side of the watershed, *Pinus koraiensis*. (*b*) With mosses of the *Hypnum* type, on steep slopes where there is closed Spruce with scattered Birch, and on mountain valley bottoms at about 1,200 m. with *Picea jezoensis* and scattered *Betula ermanii* with a different ground layer. (*c*) High-mountain with shrubs, at 1,300–1,500 m., as open stands having *Picea jezoensis* as the chief tree species, with some *Betula ermanii* and *B. platyphylla* and locally some Larch and Fir, and a shrub layer rich in species and locally dense. (*d*) With broadleaved species, on south slopes towards the Amur up to 1,000 m. with *Picea jezoensis* and Fir in about equal proportions, a second storey of *Betula platyphylla*, *B. ermanii*, *Tilia amurensis*, *Acer mono*, *A. tegmentosum*, *Prunus maximoviczii*, and an underwood of mixed species.

These dark-needled forests are uninfluenced by man and are composed of phytocoenoses developed gradually with changing climate. They are regarded as relicts of the former widespread Manchurian fratria [cf. *For. Abstr.* 7 (No. 1117)] in which thermophiles have been gradually replaced by boreal elements. Relict species are *Pinus koraiensis*, *Tilia amurensis*, *Taxus cuspidata*, *Prunus maximoviczii*, *Acer mono*, *A. tegmentosum*, and some shrubs and herbs. *Picea jezoensis* and *Abies nephrolepis* are ancient species of the Manchurian nemoral type.

Larch has in many places invaded and replaced the evergreen conifers, apparently as a result of fires. Associations of *Larix dahurica* are widely distributed over different relief and ecological types, and nearly all such forests show signs of fire. Fire also favours *Ledum palustre* in the ground layer. Larch with *Ledum* is widely spread in the region on shallow peat-gley soils: owing to the presence of stony or gravel layers at no great depth, the subsoil is not permanently frozen as under the same group of associations in other parts of the Far East, but after fire the shallow soil is readily eroded. Several Larch associations are described in detail.

On southern slopes with thin gravelly soils Larch is accompanied by xeromesophytes. Steep stony southern slopes at low levels, when subject to fire, are sometimes covered with Aspen, *Quercus mongolica* and various shrubby species. *Q. mongolica* is regarded as a relict favoured by fire rather than as an intruder.

Accounts are also given of associations of the mountain tundra [cf. *For. Abstr.* 7 (No. 1617)] and the transition zone above the tree line, and the probable post-glacial history of the vegetation is reviewed.

12.19.4. *Succession*

12.19.4 (78.8) : 23.4. JOHNSON, W. M. **Natural revegetation of abandoned crop land in the Ponderosa Pine zone of the Pike's Peak region in Colorado.** *Ecology* 26, 1945 (363–74). [Rocky Mountain Forest and Range Exp. Sta.] [1652].

Secondary succession on abandoned fields in the Ponderosa Pine zone in the neighbourhood of Pike's Peak, Colorado, progresses through the following stages:—(1) an annual-weed stage characterized by a few species occurring in great abundance (1–2 years); (2) a perennial-forb stage characterized by an increased number of perennial grasses and forbs, but having lower total densities of plant cover (7–10 years); (3) a mixed-grass-and-forb stage (10–25 years); (4) the subclimax bunchgrass stage; (5) the climax *Pinus ponderosa*/*Pseudotsuga taxifolia* association. Grazing pressure and loss of soil moisture and fertility from erosive action are the principal factors affecting succession. Grazing pressure may maintain a stand of *Artemisia frigida* and other unpalatable species indefinitely. *From author's summary.*

12.2. *Special* [*Systematic*] *Botany*

12:2 : 12.26–8. GARDNER, C. A. **Taxonomy and the species concept, with special reference to *Eucalyptus*.** *Aust. For.* 9, 1945 (7–11). [State Herbarium, Western Australia.] [1653].

The writer discusses the different concept of the species held by the botanist working intensively on a genus from herbarium specimens only, and that held by the worker in the field, studying the flora of a wide stretch of varying country. He discusses the difficulties arising from the recent tendency to establish species at the expense of varieties. If the former varieties are ranked as species without strong specific characteristics, they are frequently difficult to determine in the field, especially if derived from 'plastic' species. These difficulties are illustrated by the elevation of varieties of *Eucalyptus redunca* to specific rank (*E. wandoo*, *E. gardneri*), which leaves many intermediate forms nameless; and by the complex of *E. falcata*, *E. kesselli*, and *E. goniantha*. As a practical measure it is better to be able to refer a plant to a species (even if it is a form, variety or race) rather than to be forced to assign it to one or the other of the described forms.

12.21. Fungi

12.21 : 01.2 : 01.4. BISBY, G. R. **An introduction to the taxonomy and nomenclature of fungi.** The Imperial Mycological Institute, Kew, Surrey. 1945. pp. vii + 117. Price 5*s*. or $1.25. [1654].

This little book is intended primarily for students who are entering the field of systematic mycology. Part I (Taxonomy) has sections on choosing the group to study, equipment, collecting, examining and recording, measuring, culturing, naming and describing, preserving material, publishing and illustrating. Part II (Nomenclature) has sections on categories of fungi, synonymy, types and the type method, diagnoses. Fifty pages are devoted to the International Rules of Botanical Nomenclature, copies of which are not at present readily available. References to literature are copious.

12.21 : 02.4. AINSWORTH, G. C., and BISBY, G. R. **A dictionary of the fungi.** The Imperial Mycological Institute, Kew, Surrey. 2nd ed., 1945. pp. viii + 431. Price 20*s*. or $4.60. [1655].

The first edition of this work was published in 1943 [cf. *For. Abstr.* 5 (171)]. The chief changes and additions in the second edition are the listing of new genera (with the years in which they were made) from Supplements 1–10 (1940–44) of the *Review of Applied Mycology*; a new arrangement of the Phycomycetes; a systematic arrangement of the genera; short notes on more than 50 important mycologists; and a revision of the key to the families of fungi.

12.25-8. Spermatophyta

12.25–8 (728.1) : 01.2. STANDLEY, P. C. **Notes on some Guatemalan trees.** *Trop. Woods* No. 84, 1945 (1–18). [1656].

Data of general interest on the distribution and characters of *Taxus globosa*, *Podocarpus guatemalensis*, *Pinus ayacahuite*, *P. caribaea*, *P. montezumae*, *P. oocarpa*, *P. pseudostrobus*, *Abies guatemalensis*, *Cupressus lusitanica*, *Juniperus* spp., *Hedyosmum mexicanum*, *Alfaroa costaricensis*, *Juliania adstringens*, *Billia hippocastanum*, *Acer skutchii*, *A. negundo*, *Robinsonella* spp., *Bernoullia flammea*, *Hasseltia* spp., *Wigandia kunthii*, *Asianthus viminalis*.

12.25. Gymnosperms

12.25 (79.5). MATTHEWS, O. V. **The Robinson Juniper.** *J. For.* 43, 1945 (755–6). [1657].

Description of a form of *Juniperus occidentalis* with dense, compact growth and upright branches, found in Gilliam County, Oregon. The author proposes to name it *J. occidentalis* Hook. forma *robinsoni*.

12.25. Lȳpa, A. L. Tundrovo-vȳsokogornaya forma sibirskoy eli na yuzhnom Urale. [**A tundra/high-mountain form of Siberian Spruce in the southern Ural region.**] *Priroda* 33 (2), 1944 (65). [Russ.] [1658].

Little attention has yet been paid to forms of Siberian Spruce (*Picea obovata* Ledeb.). A variety matching specimens of V. S. Govorukhin's var. *tundricola* (from the Ob tundras; characterized merely as having cones 35–50 mm. long) was found in 1942 by the author in the alpine zone of Yaman-Tau, the highest of the S. Ural mountains. Here the variety was of creeping habit, not exceeding 0·5 m. in height but with a short erect bole; the annual shoots glabrous, with short (8–10 mm.) needles; cones up to 45 mm. but usually 25–35 mm., cone scales steeply rounded with almost entire margins. It grew on quartz and slate screes with lichen cushions, chiefly of *Cladonia* spp. and shrubs such as *Juniperus sibirica*, *Vaccinium uliginosum* and *V. vitis-idaea*.

12.26-8. Dicotyledons

12.26–8 (8). Cuatrecasas, J. Estudios sobre plantas andinas, VI. [**Studies on Andean plants, VI.**] *Caldasia* 3, 1945 (421–37). [Span.] A.P.B. [1659].

Brunellia latifolia, *B. occidentalis*, *Hedyosmum toxicum*, *H. granizo*, *H. crassifolium*, *H. colombianum*, *H. huilense*, and *H. translucidum* Cuatr. n. spp.

12.26–8 (86). Dugand, A. Noticias botanicas colombianas, V. [**Colombian botanical notes, V.**] *Caldasia* 3 (14), 1945 (357–61). [Span.] I.A.B. [1660].

Notes on *Schnella glabra* (Jacq.) Dugand, *Trichilia verrucosa* C. DC, and description of *Matisia inaequalis* Dugand, sp. nov. (Bombacaceae).

12.26–8. Monachino, J. **A revision of *Ambelania*, inclusive of *Neocouma* (Apocynaceae).** *Lloydia* 8, 1945 (109–30). [New York Botanical Garden, New York.] E.M.B. [1661].

Two species previously described in *Neocouma* are transferred to *Ambelania*, resulting in the new combination *A. ternstroemiacea* and the new name *A. markgrafiana*. *A. sagoti* and *A. tenuiflora* are placed in synonymy under *A. acida*. *Ambelania* is regarded as containing the most heterogeneous specific elements in all the genera of Carisseae in America, but nevertheless as displaying sufficient unity and integration of its components to be maintained as a single comprehensive genus. A systematic treatment of the group is presented with key, short descriptions, and bibliography. *From author's conspectus.*

12.26–8 (8) : 12.19 : 31.0. Dugand, A. El carreto o cumulá (*Aspidosperma dugandii* Standl.). [**The Carreto or Cumula (*Aspidosperma dugandii* Standl.).**] *Caldasia* 2, 9, 1944 (366–9). [Span.] I.A.B. [1662].

The geographical distribution of *Aspidosperma dugandii* Standl., and *A. curranii* Standl. The appearance and uses of the timber are indicated.

12.26–8. Monachino, J. **A revision of *Lacmellea*, and the transfer of *Zschokkea* (Apocynaceae).** *Lloydia* 7, 1944 (275–302). [New York Botanical Garden, New York.] E.M.B. [1663].

All the species hitherto placed in *Zschokkea* are referred to *Lacmellea*. Two new species and three new varieties are described in *Lacmellea*. *Zschokkea monosperma* is placed in synonomy under *L. arborescens*, and *Z. peruviana* is reduced to varietal rank under this species. A systematic treatment of the group is presented, with key, short descriptions and bibliography. *From author's summary.*

12.26–8. Dugand, A. Bombacaceae: descripcion enmendada de *Bombax coriaceum* Mart. & Zucc. [**Bombacaceae: emended description of *Bombax coriaceum* Mart. and Zucc.**] *Caldasia* 2 (10), 1944 (435–7). [Span.] I.A.B. [1664].

12.26–8 (86). Dwyer, J. D. **A new species of *Copaifera* from Panama.** *Trop. Woods* No. 83, 1945 (15–7). [Union Univ., Albany College of Pharmacy.] [1665].

Description of a new species, *Copaifera aromatica* Dwyer, from Panama, which has already received two manuscript names, one from Pittier: *C. chiriquiensis* and one from Klotsch (?): *C. punctata*. It is a tree up to 30 m. high with aromatic bark, but there is no record of its yielding the oleoresin, Balsam of Copaiba.

12.26–8 (66 : 67.1 : 67.2). Aubréville, A. Les *Combretum* des savanes boisées de l'Afrique occidentale française. [**The genus *Combretum***

in the wooded savannas of French West Africa.] Imprimerie Nationale, Paris. 1944. pp. 40. [F.] [1666].

The genus *Combretum* is represented in the wooded savannas of Africa by numerous species of shrubs and small trees. Their identification is usually a matter of considerable difficulty, and the object of this monograph is to clear up the confusion in respect of West African species. Distinctive characters of some 18 species and varieties are set out in tabular form, and the tables are followed by detailed descriptions and illustrations of the principal species.

12.26–8 (8 : 728.6). CUATRECASAS, J. Estudios sobre plantas andinas.—V. **[Studies on Andean plants.—V.]** *Caldasia* 2 (8), 1943 (209–40). [Span.] I.A.B. [1667].

Cuatrecasas' new species of *Diplostephium* are *tenuifolium*, *tamanum*, *dentatum*, *oblongifolium*, *boyacense*, *alveolatum*, *heterophyllum*, and *violaceum*; and *floribundum* subsp. nov. *cundinamarcense*. A provisional key is given to the Colombian species of *Diplostephium*.

12.26–8 (75.4). AMMONS, N., and CORE, E. L. **The Dogwoods of West Virginia.** *Castanea* 10, 1945 (88–91). [West Virginia Univ., Morgantown.] [1668].

Synoptic illustrated key to the seven species of *Cornus* indigenous to West Virginia.

12.26–8 (86). CROIZAT, L. **Euphorbiaceae novae vel criticae colombianae, II.** *Caldasia* 2, 1944 (357–62). [Span.] [Arnold Arboretum, Harvard Univ., Cambridge, Mass.] I.A.B. [1669].

Notes on the four Colombian species of *Mabea*, and a description of *Alchornea umboensis* sp. nov. (Departamento de Boyacá).

12.26–8 (86). SCHULTES, R. E. **Plantae colombianae, X. I.—De Euphorbiaceis notae diversae. II.—Investigationes specierum Saurauiae: locus tertius.** *Caldasia* 3 (13), 1945 (247–54). [Harvard Botanical Museum, Cambridge, Mass.] I.A.B. [1670].

Notes on *Cunuria spruceana* Baillon, *Hevea guianensis* var. *lutea* (Bentham) A. Ducke et R. E. Schultes comb. nov., *H. viridis* var. *toxicodendroides* Schultes and Vinton, *Senefeldera chiribiquetensis* Schultes and Croizat, and nine species of the genus *Saurauia* [see also abstracts, Nos. 1679, 1680 below].

12.26–8 (86 : 85). SCHULTES, R. E. **Plantae Austro-Americanae, IV.** *Caldasia* 3, 1945 (439–44). [E.] A.P.B. [1671].

Some phytogeographic and taxonomic observations on five species of the genus *Mayna* (Flacourtiaceae) and on *Herrania albiflora* Goudot f. nov. *titanica* R. E. Schultes (Sterculiaceae) [see also abstracts Nos. 1682–3 below].

12.26–8 (86). URIBE-URIBE S. J., L. Especies nuevas o notables del genero *Inga* en Colombia. **[New or noteworthy species of the genus *Inga* in Colombia.]** *Caldasia* 3 (14), 1945 (345–56). [Span.] I.A.B. [1672].

Includes descriptions of *I. medellinensis*, *I. microgyna*, *I. psittacorum* and *I. racemaria* spp. nov. L. Uribe.

12.26–8 (86). DUGAND, A. Nuevas especies de *Ficus* de Colombia y del Ecuador. **[New species of *Ficus* from Colombia and Ecuador.]** *Caldasia* [2] (6), 1943 (77–80). [Span.] I.A.B. [1673].

Of six new species three are trees, viz: *F. schultesii*, *F. vallis-caucae*, and *F. ynesina* Dugand.

12.26–8 (86). DUGAND, A. Nuevas nociones sobre el genero *Ficus* en Colombia, II. **[New ideas on the genus Ficus in Colombia, II.]** *Caldasia* 2 (9), 1944 (375–86). [Span.] I.A.B. [1674].

Notes on 11 species, including *F. chiribiquetensis*, *F. palmirana*, and *F. vicencionis* spp. nov.

12.26–8 (86). DUGAND, A. Nuevas nociones sobre el genero *Ficus* en Colombia, III. **[New ideas on the genus *Ficus* in Colombia, III.]** *Caldasia* 2 (10), 1944 (440–2). [Span.] I.A.B. [1675].

Description of *F. ajajuensis* Dugand, n. sp. and renaming of two other species.

12.26–8. PALIBIN, I. V. Zametka o klassifikatsii kavkazkogo platana. **[Note on the classification of the Caucasian Plane [*P. digitifolia* Palib.].]** *Bot. Zh. SSSR* 30, 1945 (95–6). [Russ.e.] O.B.D. [1676].

12.26–8 (410) : 09.1. CORNISH, V. **Historic Thorn trees in the British Isles.** Country Life Limited, London. [1941.] pp. 94 + plates. Price 8*s*. 6*d*. [1677].

12.26–8 (943 : 729.1). WHITE, C. T. **The Australian species of *Antirhea*, and a new**

name for a Cuban species. *J. Arnold Arbor.* 27, 1946 (121–2 + plate). [1678].

Corrections to *Index Kewensis* are *Antirhea tenuiflora* (nec *tenuifolia*); *A. urbaniana* nom. nov. for *tenuiflora* Urban, 1900, non F. Mueller, 1867; *A. putaminosa* and *A. myrtoides* were not previously listed.

12.26–8 (86). SCHULTES, R. E. **Plantae colombianae.—III. Investigationes specierum *Saurauiae* : locus primus.** *Caldasia* [2] (6), 1943 (27–45). [Harvard Botanical Museum, Cambridge, Mass.] I.A.B. [1679].

The new tree species are *Saurauia aromatica, caquetensis, chiliantha, echinosepala, narcissifragrans,* and *portachuelensis* by R. E. Schultes; and *Saurauia anolaimensis* and *putumayonis* by R. E. Schultes et H. García Barriga. All from Colombia. [See also abstract No. 1670 above.]

12.26–8 (86). SCHULTES, R. E. **Plantae colombianae, VI. Investigationes specierum Saurauiae: locus secundus.** *Caldasia* 2 (9), 1944 (315–23). I.A.B. [1680].

Saurauia cuatrecasana, S. omichlophila and *S. intonsa* spp. nov. R. E. Schultes (Colombia).

12.26–8. CRONQUIST, A. **Studies in the Simaroubaceae. III. The genus *Simaba.*** *Lloydia* 7 (1), 1944 (81–92). E.M.B. [1681].

After discussing the synonymy and relationships of the genus *Simaba*, the author presents a key and an annotated list of the 24 recognized American species. The genus includes good-sized trees, small shrubs or subshrubs and suffruticose plants with the leaves all basal. Only 5 of the 24 species recognized in this paper have been proposed since Engler's 1874 monograph.

12.26–8 (8). SCHULTES, R. E. **Plantae austro-americanae.—I. Novae notiones conjunctionesque generis *Herrania.*** *Caldasia* [2] (6), 1943 (11–28). [Harvard Botanical Museum, Cambridge, Mass.] I.A.B. [1682].

Descriptions of *Herrania kanukuensis* n. sp. (British Guiana) and *H. nycterodendron* n. sp. (Perú and probably the southern part of Colombian Amazonas); new combinations *H. lemniscata* (Schomburgk) R. E. Schultes, and *H. nitida* (Poeppig) R. E. Schultes. *H. nitida* (Poeppig) R. E. Schultes var. nov. *sphenophylla* is recorded from northeastern Perú and southern Colombia. [See also abstract No. 1671 above.]

12.26–8 (8 : 728). SCHULTES, R. E. **Plantae austro-americanae, II. De investigationibus generis *Herrania* diversae observationes.** *Caldasia* 2, 9, 1944 (325–36). I.A.B. [1683].

Botanical notes on previously recorded species of *Herrania* and *Theobroma*. A new combination, *Herrania purpurea* (Pittier) R. E. Schultes is proposed.

13. FOREST ZOOLOGY

13.1. *General Zoology*

13.1 : 13.2. DUNCAN, C. D., and PICKWELL, G. **The world of insects.** McGraw-Hill Book Company, Inc., New York and London. 1939. pp. ix + 409 + plate. Price 21*s.* [1684].

A general view of insect life presented popularly and based on the North American fauna. Chapters deal with insect structures, how insects grow up, reproduce, breathe, move, and are protected; foods, feeding habits and food-getting devices; insect voices, fitness, social life, value, control. Nine pages tabulate the characters of the orders and summarize the descriptive matter. There are instructions on where to look for insects and on rearing, collecting and preserving. References to forest insects are few.

13.15 : 12.19 (78.7). BLAKE, I. H. **An ecological reconnaissance in the Medicine Bow Mountains.** *Ecol. Monogr.* 15, 1945 (207–42). [Department of Zoology, Univ. of Nebraska, Lincoln, Neb.] [1685].

This paper is offered as an introduction to some of the animal communities of the Medicine Bow Mountains in southern Wyoming. The greater number of species are those characteristic of coniferous regions. In the forests, the most consistently favourable living conditions for many arthropods are afforded by decaying logs, under which or beneath the broken bark occur nearly all the permanent ground inhabitants, together with larvae of a few noctuids and of many beetles and flies. Typical forests harbour the greatest variety of species responsive to moderate intensities of such factors as radiant energy and wind, and poorly equipped to resist desiccation, as well as many other animals during the breeding season. Aspen subclimax supports conspicuous phytophagous populations. The dry

Lodgepole Pine habitat shows a high proportion of carnivorous invertebrates. The Spruce/Fir forest, offering maximum protection from climatic extremes, maintains representatives of the largest number of orders and families, resulting in the most complex community. *From author's summary.*

13.15 : 12.19 (81). DAVIS, D. E. **The annual cycle of plants, mosquitoes, birds and mammals in two Brazilian forests.** *Ecol. Monogr.* 15, 1945 (243–95). [1686].

The investigations described in this paper were part of a programme for learning more about the lives of Brazilian forest animals in order to find what species may fit the role of hosts and vectors of the jungle yellow fever virus. Since a knowledge of abundance and of movements of animals is fundamental to an understanding of the maintenance and spread of the virus, the investigation concerned these two aspects of mosquitoes, birds and mammals. The plants in the forest were investigated, to obtain a better understanding of the habitat. Tables are given, showing the composition of a sample of *Hortia/Virola/Croton* forest and a sample of *Callichlamys/Vochysia* forest, indicating numbers of each species by 5 cm. classes and those species used for timber or firewood, the months of flowering and fruiting, and persistence of leaves. The two forests studied are about 100 km. north of the city of Rio de Janeiro. The first contains much second-growth forest and the other much virgin forest. The first forest is about 25 m. high and presents a uniform green appearance. There are three distinct vegetational layers: mature trees about 25 m. high, younger trees about 20 m. high, and a layer of shrubs near the ground. There are many epiphytes and lianas. Two large trees, *Hortia arborea* and *Virola bicuyba*, and one small tree, *Croton salutaris* are abundant and characteristic of this plant association. A preliminary survey of the nearby forest permitted a tentative outline of the succession which preceded this association. The second forest is about 30 m. high, has a definite middle layer of vegetation, and lacks undergrowth. Bamboos are rare, but lianas and epiphytes are common. Two species of trees, *Callichlamys latifolia* and *Vochysia laurifolia*, are characteristic of the forest and are present at all ages. The family Lauraceae is represented by numerous species of large trees, and the Rubiaceae by many small trees.

A comparison of the plants, mosquitoes, birds and mammals in the two forest associations shows great differences. The tree species are markedly different, only 20 per cent. of them being common to the two forests. The species of mosquitoes and mammals present great differences in the two types.

13.15 : 13.2 : 45.3. MACKENZIE, J. M. D. **Forest ornithology. (Some meditations.)** *Scot. For. J.* 59, 1945 (55–69). [1687].

Forest ornithology consists of the study of the habits of common birds in order first to decide whether they are beneficial or not, and secondly to use the habits of desirable species so as to get them where and when they are wanted, in the most suitable numbers. A point often overlooked is that nestlings are almost always fed on a mainly animal diet, and that during that period adults eat much the same food as their nestlings. As a nestling and while growing, a bird eats very large quantities of food for its size, and the mortality among birds in the period just after leaving the nest is very high. It may be said, in rough figures, that while 100 birds (adults and nestlings) eat an insect diet at a time when their appetites are very big, only 50 or 60, allowing for adults, eat the less beneficial adult diet during the rest of the year. A point worth noting is that the size of clutches of eggs depends to some extent on the food supply, so that an excessive insect population will lead to an increase in the number of birds which prey on them.

There is a sequence of birds which live in plantations, from the formation onwards. In the first years the birds are those of open spaces or weedy patches; when the canopy is formed, about the 8th to 10th year, these are replaced by hedgerow or thicket birds, which remain the main type until the trees are big enough to contain holes or to carry nest boxes, which is not until the 20th to 40th year, when tits, woodpeckers, nuthatches, etc. begin to nest. In younger plantations, up to 30 or 40 years old, before nest boxes are put up, there seems to be a distinct preference for the Spruces, especially Sitka Spruce, while Scots Pine and Larch are very unpopular.

It might be advisable to plant up suitable patches of ground in plantations with Sitka Spruce which would serve as nesting sites from which birds would feed in the surrounding plantation of species unsuitable for nesting.

The wetter spots would be suitable for this purpose; a plot of ¼ acre should supply nesting sites for birds to police 30 acres round it.

Broadleaved woods are not necessarily well stocked with birds, and the numerous birds found in them are often not nesting in the trees proper, but in holes in them, ivy round them, and weeds beneath them. Properly managed broadleaved woods may want as much help from the forester as conifers, in order to maintain their bird populations.

The timing of certain forest operations is of importance in connexion with nesting, which takes place mainly from April to July. From the beginning of April to the end of July, therefore, operations such as weeding, cutting coppice shoots, and brashing of Spruce, should not be done.

Not much investigation has been done on Bats as controls for insect pests in plantations, but their diet and large appetities give promise of effectiveness. [Cf. *For. Abstr.* 7 (No. 2057)].

13.2. *Special* [*Systematic*] *Zoology*

13.2 (410). KLOET, G. S., and HINCKS, W. D. **A check list of British insects.** Kloet and Hincks, 322 Wellington Road North, Heaton Chapel, Stockport. 1945. pp. lix + 483. Price £2 2s. [1688].

13.2 (67.5). EGGERS, H. Neue Borkenkäfer (Col., Scolytidae) aus Afrika. Nachtrag X. [**New bark beetles (Col., Scolytidae) from Africa. Supplement X.**] *Rev. Zool. Bot. afr.* 33, 1940 (227–39). [G.] [1689].

The following new species are described: *Diamerus imperfectus, D. inermis, Pseudophloeotribus seriatus, Bothryperus major, B. uniseriatus, Peronophorus obscurus, Strombophorus variegatus, Stephanoderes bambesanus S. subvestitus, S. perpunctatus, S. subcylindricus, S. macrolobii, S. mulongensis, S. confusus, Ctonoxylon nodosum, Xyleborus similans, X. subasperulus, X. posticespinatus, X. bambesanus.* With the exception of *S. confusus* which was found in Southern Rhodesia, all are from the Belgian Congo.

13.2 (67.5). EGGERS, H. Neue Borkenkäfer (Col. Scolytidae) aus Afrika. Nachtrag XI. [**New bark beetles (Col. Scolytidae) from Africa. Supplement XI.**] *Rev. Zool. Bot. afr.* 38, 1944 (92–8). [G.] [1690].

The following new species are described:—*Strombophorus testudo, Rhopalopselion confusum, Metahylesinus sulcatus, Archeophalus ealaensis, Thamnurgus punctatissimus, Mimips camerunus, M. sexdentatus, Premnobius declivis, Xyleborus capensis.* The two last-named are from the Cape, *Mimips camerunus* from Cameroon, and the rest from the Belgian Congo.

13.2 (67.5) : 45.3. GHESQUIÈRE, J. Recherches sur les Diptères d'Afrique. II. Notice monographique sur les Muscoides Cryptochaetidea, parasites de Coccides Monophlebinae. [**Researches on African Diptera. II. Monograph on the Cryptochaetidae parasitic on the coccids Monophlebinae.**] *Rev. Zool. Bot. afr.* 36, 1942 (390–410). [F.] [1691].

The accidental introduction into the Belgian Congo on imported plants from Australia of the dangerous pest of Citrus fruit trees (*Pericerya purchasi*), led to a search for parasites as an effective control. The principal enemy of *P. purchasi* is *Cryptochaetum iceryae.* and there are also other species of *Cryptochaetum.* This article gives a general account of the *Cryptochaeta* with more detailed descriptions of the African species, their distribution, habits and parasites, and a key for identification of species.

13.2 (66.4) : 12.26–8 : 91.4. THOMSON, R. C. M. **Studies on the breeding places and control of *Anopheles gambiae* and *A. gambiae* var. *melas* in coastal districts of Sierra Leone.** *Bull. ent. Res.* 36, 1945 (185–252 + plates). [1692].

Anopheles melas (*A. gambiae* var. *melas*) is now known to be an important vector of malaria in coastal districts in West Africa. Dense breeding of this species is mostly confined to brackish water and to areas flooded by the high spring tides. The characteristic trees of the tidal zone are two Mangroves—*Rhizophora* and *Avicennia.* Breeding takes places, for the most part, in the characteristic pure stands or 'orchards' of *Avicennia,* while *Rhizophora* areas are comparatively free from infestation. The importance of the *Avicennia* orchards as breeding places does not depend so much on the presence of the Mangrove trees as on the flat, badly drained, peaty soil in which they grow. When the *Avicennia* trees are removed, breeding still continues in the open spaces and among the salt-marsh plants which rapidly invade the area. Since the *Avicennia* areas show up well in good vertical aerial photographs, this method is being used more and more to locate and map possible breeding grounds.

13.2 (410). Bedwell, E. C. **The county distribution of the British Hemiptera-Heteroptera.** With note by A. M. Massee. *Ent. mon. Mag.* 81, 1945 (253–73). [1693].

The recorded distribution by counties of 499 species occurring in England and Wales is given in tabular form.

13.2 (67.5). Saeger, H. de. Quelques Braconides nouveaux du genre *Microbracon.* **[Some new Braconids of the genus *Microbracon.*]** *Rev. Zool. Bot. afr.* 36, 1942 (361–389). [F.] [1694].

The new species were found as parasites of various insects infesting different plants including *Acanthus arboreus*, *Copaifera demeusei*, *Daniellia thurifera*, and *Pentaclethra macrophylla* in the Belgian Congo.

13.2 (67.5) : 45.3. Ghesquière, J. Contribution à l'étude des Hyménoptères du Congo belge. VIII. Sur deux Chalcidiens Encyrtidae nouveaux pour la faune congolaise. **[Contributions to the study of the Hymenoptera of the Belgian Congo. VIII. Two Chalcids (Encyrtidae) new for the Congo fauna.]** *Rev. Zool. Bot. afr.* 35, 1941 (133–5). [F.] [1695].

Anicetus parvus Compère and *Bothrophryne ceroplastae* Compère are recorded as parasites of *Ceroplastes quadrilineatus*. It is suggested that they might be used to control *Ceroplastes destructor* which is sometimes a pest of Tea, Coffee and Cocoa plantations in Africa and which, accidentally introduced into Australia, has proved a serious pest of Citrus plantations.

13.2 (410). Heslop, I. R. P. **Check-list of the British Lepidoptera with the English name of each of the 2,299 species.** Published for the author by Watkins and Doncaster, 36 Strand, London, W.C.2. 1945. pp. 35. [1696].

13.2 (410) : 13.1. Ford, E. B. **Butterflies.** *New Naturalist Series.* Collins, St. James's Place, London. 1945. pp. xiv + 368. Price 16*s.* [1697].

British butterflies, their origin, races and subspecies, distribution (maps) and dispersal, fully illustrated with colour photographs. Problems relating to structure, the senses, classification, habits, genetics, and the history of British butterfly collecting are covered in greater and more scientific detail than in most books on natural history.

2. SILVICULTURE

2 : 02.1 (47.0). Kolpikov, M. V. Obshchee lesovodstvo s opisaniem lesnykh porod. **[General silviculture, with descriptions of forest species.]** Goslestekhizdat, Moscow. 1944. pp. 388. [Russ.] [1698].

A textbook designed to cover the silvicultural curriculum of forestry technical schools. Part I (128 pp.), arranged by families and genera, gives for each important native and exotic woody species a botanical description and an account of its silvicultural characters, wood, and ecological features. Part II (14 pp.), outlines the vegetation of the U.S.S.R. under the headings: tundra, forest zone, steppe, Crimea and Caucasus, the Far East, and Central Asia. Part III (104 pp.) deals with the interaction of the forest and environmental factors under the headings: light; temperature; moisture; wind; the soil; tree classes; tree growth; the silvicultural significance of the ground flora and underwood; natural regeneration; natural and artificial pruning; stand composition and structure, age, density, site and timber quality; forest types, with special reference to the important Spruce, Pine, Larch and Oak types. Part IV (117 pp.) deals mainly with silvicultural (felling) systems and tending of stands, with chapters on clear-felling (containing a special discussion of factors influencing and measures to encourage natural regeneration), and other systems (strip, group-selection, *Saumschlag*, selection, Dauerwalfd, 'provisional clear felling, 'concentrated' (organized large-scale) fellings and fellings in coppice and coppice with standards); cleanings, thinnings, etc.; slash disposal; minor forest uses, e.g. grazing, hay and branch fodder, and other uses.

There are numerous line drawings, especially in the dendrological section, a bibliography (entirely Russian) and a subject index.

21. SILVICULTURAL CHARACTERS OF TREE SPECIES

21 : 31.0. Solov'ev, K. P. Nekotorye biologicheskie osobennosti melkolistnogo klena. **[Some biological characteristics of *Acer mono*.]** *Sovetsk. Bot.* 13, 1945 (52–9. [Russ.] O.B.D. [1699].

Of the 7 species of Maple in the Far East, *Acer mono* is the largest, most wide-spread and most valuable. It is a typical second-storey species in Manchuria, but large trees are found in *Pinus sibirica*/broadleaved forests on steep mountain slopes, and in *Abies holophylla*/broadleaved forests in the south. Singly or in mixture it occurs in various Oak types.

A. mono is a shadebearer with a fairly dense low crown, slow natural pruning, rarely found in sunny places, but growing satisfactorily and fruiting well under canopy. It prefers a good soil though fairly tolerant of poorer soils and avoiding damp ones. A maximum height of 24 m. and diameter of 70 cm. are reached; the average height at 90 years is 15 m. with a mean diameter of 16 cm., and at 180 years 21 m. and 40 cm. respectively. Above diameters of 16 cm., diameter increases by 4 cm. with every one metre in height. Wind resistance is good, but trees are sensitive to fire and frost, and to heartrot and other defects when growing in mixed broadleaved forests on southern aspects with Oak dominating.

Regeneration both by seed and coppice is good. Trees felled from 20th March to 1st July sprouted the same summer; those felled from 1st July to 15th August sprouted in the autumn of the same year. Coppice shoots develop most strongly in the region of the root collar and to a height of 25 cm. The sprouting capacity was greatest in the period of highest current increment (88 per cent. of stumps of 88-year-old trees sprouted); but no marked decline in coppicing occurs until 10–20 years after increment has begun to fall.

Sap flow in the Vladivostok region begins on 15 March and ends with the beginning of leaf opening towards the end of May. The sap contains 2·5 per cent. sugar, differing little from that of the American *A. saccharum*, though the sugar content of sap of other Far-Eastern Maples (*A. pseudo-sieboldianum*, *A. mandshuricum*, and *A. tegmentosum*) is only 0·5–1·5 per cent.

The wood is white, hard, close-grained and heavy (sp. gr. 0·62–0·72), with a false heartwood, which develops only after 60–80 years of age and has a mean diameter in 70- to 80-year-old trees of 2 cm., and in 191- to 210-year-old trees of 23·3 cm.; about 1–2 hours after felling this tissue turns bright brown with a yellow ring 2–3 mm. wide around it, this discoloration disappears directly with the drying of the wood, and towards the autumn of the same season there is no difference at all in colour of heartwood and sapwood.

The species is recommended for plantations in agricultural districts and also as a good garden and park tree.

21.0. *Adaptability to the General Environment. Acclimatization*

21.0 (489) : 12.26–8 : 57 : 31.2 : 23.3. Bornebusch, C. H. Rødeg i Dansk Skovbrug. **[Red Oak in Danish forestry.]** *Forstl. Forsøgsv. Danm.* 15, 1945 (357–96). [Dan.e.] [1700].

Red Oak (*Quercus borealis*) was introduced into Denmark in the 18th century, but was used only as a park tree until about 1880. Most of the forest stands were established during the present century, and the total area of Danish stands of this species is less than 200 ha.

The mensurational data obtained show that the early height growth of the species is rapid and much exceeds that of Danish Pedunculate and Sessile Oak. On stiff, moist soils, however, it is later overtaken by the native species, though on fresh, well drained soils, and particularly on poor sandy soils it appears to retain its superiority. On the poorest heathlands of the *Cladina* type it does not thrive.

Heavy thinnings have been made, and this has reduced basal area to 9–12 sq.m. per ha. after thinning. Permanent-sample-plot data for a 60-year-old stand on a wet, stiff clay site show that the mean annual increment culminated at 40 years with 7·6 cu.m. per ha., and that the current annual increment between 54 and 60 years was 6·6 cu.m. per ha. The total volume production per ha. was 436 cu.m. as compared with 450 cu.m. for native Oak on site quality 2. On better, lighter soils, stands 26–33 years old showed current increments varying between 9 and 13 cu.m. per ha. while on heathland the figure was 7·5 cu.m. per ha. Thus in volume production Red Oak appears inferior to native Oak on wet clays but superior on better drained and even on poor, sandy soils.

The form of the trunks differs little from that of the native species, but Red Oak appears to form heartwood more rapidly, and in spite of its broader annual rings, has proportionately less sapwood than Pedunculate Oak.

Wood from a log of Danish Red Oak showed better physical properties than indicated by data for American-grown material; its durability, however, seems inferior to that of native Danish Oak.

Red Oak produces good acorn crops in Denmark; the acorns retain their viability longer and are easier to store and transport than those of the native species. Direct sowing is the quickest and most reliable means of raising stands, but planting may be preferred if seed is to be economized. Though not recommended for true (native) Oak sites, Red Oak appears promising as a species for sandy soils such as those of the heathland and dune plantations, either in mixture or as pure stands, and should be valuable in these localities as a soil improver.

21.0 (54.87). CEYLON. **Silvicultural Research Administration, 1943.** Typescript. 1945. pp. 14. [1701].

Eucalyptus pilularis, *E. regnans*, *E. saligna*, *E. paniculata*, and *E. citriodora* appear to regenerate naturally in Ceylon. *E. saligna* at Haputala has made remarkable growth. The dominants of a plantation of 1935 are now over 80 ft. high and 2–3 ft. in girth at breast height. The stem/crown ratio is about one-sixth to one-seventh, indicating that they might have done even better with heavier thinnings. There are some very large trees, up to about 125 ft. in height and 6–7 ft. girth at breast height, in the 1923 plantations.

Cupressus species have done very well, but *Pinus*, with the exception of *P. patula*, have all failed badly (p. 3).

21.0 (66.7) : 12.26–8 : 12.19. KINLOCH, D. (Compiler). **Silvicultural notes on some of the more important Gold Coast trees.** Govt. Printing Department, Accra. 1945. pp. 70 + map. [1702].

A companion volume to Gold Coast Timbers [see *For. Abstr.* 3 (307)], a second edition of which is under consideration. The notes are elementary, but indicate certain silvicultural properties of 29 of the more important indigenous species and a few exotics (*Azadirachta indica*, *Cassia siamea*, *Cedrela mexicana*, *Dalbergia sissoo*, *Gmelina arborea*, *Tectona grandis*).

21.0 : 23 : 24 : 12.25 (67.6) : 57 : 60.31 : 98.1. WIMBUSH, S. H. **The management of Cypress plantations in Kenya.** *Pamphl. For. Dep. Kenya* No. 11, 1945. pp. 31. [1703].

This pamphlet summarizes the Forest Department's present knowledge of formation and management of Cypress plantations in Kenya. The species now grown include *Cupressus macrocarpa*, *C. lusitanica*, *C. torulosa*, *C. arizonica*, *C. sempervirens* var. *horizontalis*. The first two are recommended for commercial softwood plantations on suitable sites in Kenya in mixture with suitable broadleaved species, of which the following are recommended: *Grevillea robusta*, *Acacia melanoxylon*, *Dombeya goetzenii* and *Polyscias kikuyuensis*. The method of mixture recommended is by alternate lines or by strips of 5 rows of broadleaved trees to every 20 rows of Cypress. The planting distance recommended is 8 × 8 ft. for both Cypress and broadleaved trees. Thinning must be made at short intervals during the first 15 years when rate of growth is at a maximum, in order to maintain diameter increment at a steady rate that will allow an average d.b.h. of 20 in. to be reached by the crop in 35 to 40 years. Pruning of green branches up to a height of 38 ft. in 5 operations is recommended for adoption as standard practice. Experiments have indicated that *C. macrocarpa* is more tolerant of drastic pruning than *C. lusitanica* but that both species may safely be pruned to one-third total height at 3 years old and one-half total height at 6 years old, without affecting rate of growth. It is shown that the increase in value of standing timber due to pruning is 11 cents per cu. ft. while the cost of pruning, including compound interest at 3 per cent. for 30 years, is estimated to amount to one-third of 1 cent per cu. ft.

It is estimated that final yield from *C. macrocarpa* at 35 to 40 years old will be about 8,000 cu. ft. (true measure) of timber per acre. Intermediate thinnings are estimated to yield about 2,000 cu. ft. per acre. *From author's summary.*

21.1. *Light and Temperature Requirements*

21.11 : 12.25 : 23.23.19. MÜLLER, M. Keimung von Licht- und Schattenhölzern. **[Germination of light-demanding and shade-bearing tree species.]** *Schweiz. Z. Forstw.* 96, 1945 (131–4). [G.] [1704].

Spruce, Larch and Silver Fir seed germinated throughout in the order given, under 3 different degrees of illumination. Moisture was of decisive importance, since all seeds germinated most rapidly in darkness (low evaporation) and slowest in full light (greatest evaporation), those in indirect light showing intermediate results. In the field a case has been observed in which Larch regeneration occurred frequently on the northern side of small elevations (30–50 cm. high) but was entirely lacking a few cm. away on the southern side.

21.11 : 12.26–8 : 47 (54.87). CEYLON. **Silvicultural Research Administration, 1943.** Typescript. 1945. pp. 14. [1705].

Line-planting trials in coppice at Yakkatuw have confirmed that Malaboda (*Myristica laurifolia*) cannot be grown successfully in full open sunlight owing to attacks by scale insects followed by root fungus. The contrast in growth and condition of plants in 'open' and 'closed' sections is striking. Iriya (*Myristica iriya*) is more accommodating and is doing very well in 'open' sections (p. 11).

21.8. *Phenology*

21.8 (76.1) : 91.4. PENFOUND, W. T., HALL, T. F., and HESS, A. D. **The spring phenology of plants in and around the reservoirs in North Alabama with particular reference to malaria control.** *Ecology* 26, 1945 (332–52). [Botany Department, Tulane Univ., New Orleans, La.] [1706].

The results of observations on the phenology of plants in the Alabama section of the Tennessee Valley from 1941 to 1944 are presented. The growth of woody species was initiated in late February with the production of flowers by the Black Alder (*Alnus rugosa*), Hazelnut (*Corylus americana*) and 3 species of Elm. Species growing under natural conditions resumed activities 7–10 days later than the same species growing in towns and cities. On the average, woody species came into flower about two weeks before they reached full foliage, while herbaceous plants blossomed about 4 weeks after full verdure was attained. Species which began flowering in February or March exhibited longer anthoperiods (5–6 weeks) than those which began flowering in April, May or June (3–4 weeks).

Of the more important species in relation to malaria control, the Black Willow (*Salix nigra*) and Green Ash (*Fraxinus lanceolata*) began flowering in mid-April, whereas the Buttonball (*Cephalanthus occidentalis*) and Trumpet Vine (*Campsis radicans*) did not begin until June.

The following events usually occurred about 2 weeks before the beginning of the breeding season of *Anopheles quadrimaculatus*: (1) appearance of the first leaves of Lotus (*Nelumbo pentapetala*), (2) flowering of the Cowlily (*Nuphar advena*), (3) flowering of the Black Willow. Such phenological data can be applied to larval control through proper preparation and adequate maintenance of reservoirs, e.g. by water-level management, limitation of plants along shallow shorelines, keeping plants in an early stage of development, etc. *From authors' summary.*

21.8 : 12.26–8 : 12.11.21. HUXLEY, J. **Late flowering of Horse-Chestnut.** *Nature* 156, 1945 (574). [1707].

Horse-chestnuts in the streets of Paris flowered in early October. The flowers were borne by trees prematurely withered by severe frost followed by very dry weather in the spring, but bearing a few branches or shoots with normal leaves. It appears that premature damage to the foliage had stimulated the production of new shoots from buds that would normally have developed in the following spring and that some of the shoots had managed to flower as well as to produce new leaves.

21.8 : 12.26–8. BAKER, H. G. **Late flowering of Horse-Chestnut.** *Nature, Lond.* 156, 1945 (721). [Botany Department, Leeds Univ.] [1708].

At the beginning of October 1944, flowering was noticed on a tree of *Aesculus hippocastanum* at Twickenham, which had been severely damaged by frost in May. At the same time, two trees of the same species, which had been completely defoliated by blast from a flying bomb in August also flowered until the blossoms were killed by frost. In 1945 the three trees produced fewer leaves than usual and very few inflorescences. Most of the buds containing inflorescences must have been used in the autumn flowering. The mild autumn weather experienced in 1944 may be connected with the second flowering. It would appear that it is the already defoliated condition of the trees of *A. hippocastanum* at the usual time for the commencement of leaf fall which stimulates the opening of the buds at that time, the production of new leaves and inflorescences in the buds proceeding at the same rate during the summer whether mature leaves are present or not.

21.8 : 12.29 (54.2) : 12.26–8 : 23.2. NICHOLSON, J. W. **Flowering of *Bambusa arundinacea* in Orissa.** *Indian For.* 71, 1945 (145–6, 435–6). [1709].

It was decided to take advantage of the gregarious flowering of *Bambusa arundinacea* in Orissa early in 1945 to eradicate the Bamboo and interplant Teak in its place. The plan was to fell or burn the Bamboo before the seed had ripened, but it was frustrated by the seed's maturing much earlier than was expected and by further successive flowering and seeding. Bamboo clumps which had been successfully burnt in March 1945 proceeded to send up fresh shoots which flowered and seeded in May, and in some cases a third flowering and seeding took place in June. [See also *For. Abstr.* 7 (Nos. 1717, 1720, 1752, 1754).]

22. SILVICULTURAL SYSTEMS. FORMS OF STAND

22.1. *High Forest Forms*

22.1 (75.6 : 75.7) : 12.19.2 : 60.31. JEMISON, G. M., *et al.* **Cutting practices for the Carolinas. Report of Cutting Practices Committee, Appalachian Section, Society of American Foresters.** *J. For.* 43, 1945 (861–70). [1710].

The final report of a committee appointed by the Appalachian Section of the Society of American Foresters 'to crystallize present consensus of desirable silvicultural practices in the Carolinas'. The committee has adopted as its guiding principle the policy that all commercial forest cutting operations should be so conducted as to leave land continuously productive of forest crops. The recommended practices do not specify the volumes that may be removed, provided the conditions for restocking and cutting in young stands are met. Cutting practices are recommended for 13 types or groups of types in North and South Carolina.

22.1 : 12.25 : 66 (77.4). DAY, M. W. **Spruce-Fir silviculture.** *Quart. Bull. Mich. agric. Exp. Sta.* 28, 1945 (59–65). [1711].

The White Spruce/Balsam Fir/Paper Birch type is one of the most important sources of pulpwood and, by its growth rate and value, presents one of the most favourable opportunities for profitable forest management in Michigan. The essential points in the management of this type are (1) to cut early, often, and lightly, (2) to protect young growth, (3) to remove overtopping hardwoods. Spruce/Fir stands being cut by the selection system should be operated on short cutting cycles, if practicable. On average sites, cuts of 25 to 50 per cent. of the merchantable volume are possible with cutting cycles of 10 to 20 years. The desirability of marking all stands before cutting is strongly emphasized.

A large proportion of any of the hardwood species is generally undesirable. Owing to its suckering ability, it is usually undesirable to cut Aspen at the same time as Spruce and Balsam Fir, unless the cut is light and the overhead cover left will be too heavy to allow the development of the Aspen suckers. Fully stocked plots from which 25 per cent. of the merchantable timber has been removed still have too much shade for Aspen suckers to make good growth. Red Maple and Birch are aggressive seeders and should be cut out.

Studies have shown that logging damage can be reduced to a reasonable level by the use of simple protection measures. The one-horse method of logging should be employed wherever possible; only the minimum number of young trees should be cut to facilitate felling and skidding; since Fir is more easily injured than Spruce, it should be cut more heavily in order to increase the proportion of Spruce in the residual stand.

22.12 : 01.2. DRUMMOND, R. O. **'Seeding felling'.** *Indian For.* 71, 1945 (335–6). [1712].

In working plans for Chir (*Pinus longifolia*) in the United Provinces, and very possibly in other parts of India and for other species also, 'seeding felling' has come to have two distinct meanings; (A) for the first regeneration felling in a regeneration area, and (B) for a final felling leaving seedbearers in a crop which is too old, open or unhealthy to be accepted for future crop. The writer would like to have the term 'seeding felling' confined to the second of these meanings, and suggests that some such phrase as 'primary felling' should be used for the first.

22.2. *Coppice Forest*

22.22 : 24.2 : 33.06 : 76 (66.9). WYATT-SMITH, J. **The Ibadan fuel plantations.** With comment by F. S. Collier. *Farm and Forest* 6 (2), 1945 (95–9). [1713].

An account of the progress made, and plans for the future of the fuel plantations at Ibadan in Nigeria.

It has been shown experimentally in the 1942 plantations that strip cleaning with or without hoeing gives no appreciable advantage. Teak has been the principal species planted, with *Cassia siamea* on steep slopes. *Cassia* has not competed very well with the speargrass, and, unlike Teak, does not clean itself after coppicing, though it grows faster than Teak in its early stages. Trials were made during 1943 with sowing Teak at stake but, although germination was good, the seedlings were not vigorous and compared very unfavourably with stumped Teak planted subsequently at the beginning of the heavy rains. It appears that it pays to spend money in the nursery in producing really strong seedlings, and to have them stumped and carefully planted out at a year old when the rains have begun in earnest. Subsequent cleaning is reduced to a minimum, with a consequent decrease in establishment costs, and it will probably be found also that the rotation might well be reduced by one year. Several of the compartments have now been clear felled three times, but their coppicing vitality still appears to be good. In fact a thinning of coppice shoots to 2 per stool in an 8-year-old crop of Teak, originally planted in 1912, has resulted in intense development of new shoots even under the remaining dense shade. Teak appears to clean itself to 2 or 3 main stems after 5 years, but *Cassia* is very persistent and however many shoots there are, none appear to be suppressed. Thinning of *Cassia* should be postponed until at least 18 months after felling, and further thinning should be done 5 years after felling. All compartments are thinned for poles one year before being clear felled for firewood. For the normal firewood and pole requirement of Ibadan an 8-year rotation, especially with *Cassia*, is too short, and 10 years is definitely preferable. A reduction to 8 years, after the first rotation, may be possible with the new thinning technique.

A revenue of about £13 per acre can be expected from the plantations with the present demand and selling prices for poles and firewood, on a rotation of 10 years. Establishment costs are estimated at an outside figure of £7 10*s*. per acre.

22.8. *Silvicultural Description of Forms of Stand*

22.82.1 (212) : 12.19. Jones, E. W. **The structure and reproduction of the virgin forest of the north temperate zone.** *New Phytol.* 44, 1945 (130–48). [Imperial Forestry Institute, Oxford.] [1714].

In this paper an attempt is made to review some features of the structure and reproduction of the north temperate virgin forests, and to consider their bearing on ecological theory. An account is first given of the somewhat scanty material for the study, and the salient facts of sizes and ages of trees, and the volume of timber present, are summarized. Very commonly the age attained by dominants seems to be about 300 years. *Abies alba* in Europe, *Pinus koraiensis* in Eastern Asia, and the dominants of the North American forests reach an age of about 350 years. The dominants in northern coniferous forests seem to be somewhat shorter lived. The height attained by the dominant species under good conditions throughout Europe and in much of North America is commonly about 100 ft., rising to 150 ft. in exceptionally favourable conditions. A very common maximum diameter for dominants growing in closed stands is 40 in. In the northern coniferous forests sizes are much smaller. The Pacific coastal forests of North America are unique in the northern temperate regions in having species which attain far greater ages and sizes than those recorded above. There can be a great range in volume of timber. A figure of 193 cu.m. per ha. has been calculated for America, which may be compared with the 340–400 cu.m. per ha. often accepted by European foresters as satisfactory for managed selection forest.

Even-aged stands are apparently common in virgin forest, and are usually regarded as originating after fire. Even-aged components of otherwise uneven-aged crops also seem to be common. These often take the form of an over-storey of widely spaced individuals standing in an uneven-aged matrix of other smaller species. This suggests that succession is still in progress, especially since the even-aged species is always relatively intolerant and not regenerating. The even-aged group structure, such as would be produced if the mass seeding of gaps made by wind or snowbreak were the usual method of regeneration, has not often been recorded, but is probably commoner than the available data suggest. All-aged forest with irregular canopy answering to the forester's picture of 'selection forest' appears to be rare. A much commoner form of uneven-aged forest has a regular, continuous canopy and has much the appearance of an even-aged high forest. Regeneration in such forests often appears to be absent, and there is a striking deficiency of the smaller stems. This, however, does not necessarily mean that the forest is not reproducing itself and maintaining its present structure: the condition doubtless arises through the relatively small fraction of the life of a tree spent in growing from ground level into the canopy when a gap is formed. Where the average life is 300 years, only 2 or 3 gaps per ha., each containing 1 or 2 young stems, would be sufficient to perpetuate the forest. The studies of Mauve and Iwaschkewitsch in this kind of forest are described in some detail.

The even-aged condition implies widespread destruction followed by complete regeneration within a limited period of time. Fire has usually been regarded as the principal destroyer, and the evidence for natural occurrence of fire is reviewed. Other agencies are climatic change, windthrow on a large scale, irregular seed production, drought, inundation, the retreat of glaciers. It is suggested that cycles in mammalian population may also be important in determining periods of regeneration. It seems likely that once an even-aged stand is established it may persist through several generations (not necessarily of the same species).

In a wide range of forests death by old age is usual, and very large amounts of dead wood are present at all stages.

In a discussion of the relation of virgin forest to the ecological theory of the climax, the writer suggests that it is conceivable that 'climax forest' is a concept only, never existing in practice, either because of catastrophic initiation of fresh seres, or because of the time lag (necessarily great where long-lived trees are concerned) in the adjustment of the vegetation to an ever-changing environment. [Cf. *For. Abstr.* 7 (No. 2116).]

23. FORMATION OF STANDS

23 : 12.26–8 : 24 : 12.19.2. KURTH, A. Die waldbauliche Rolle und Behandlung der Buche auf planzensoziologischer Grundlage. **[The silvicultural rôle and treatment of Beech on the basis of plant sociology.]** *Schweiz. Z. Forstw.* 96, 1945 (98–110). [G.] [1715].

Natural Swiss Beech woods are all considered to belong to the *Fagetum praealpino-jurassicum*, but there are many sub-associations that are as yet little investigated. On rocks rich in carbonates the parent material is the chief determining factor in soil development, and rendzina or humus-carbonate soils are formed under Beech. With other sedimentary rocks relief largely determines soil development, and soils of the brown-earth series are formed: on ridges and hill tops leaching is heavy and a mor humus forms (types with *Vaccinium*); upper slopes and steep 'shoulders' show light podzolization (types with *Luzula*); lower slopes and valleys have mature brown-earth soils (types with *Dentaria*). Stand structure varies greatly with site, but, except where accompanied by Silver Fir, Beech tends to develop a uniform type of structure. Beech/Silver Fir stands are among the most suitable for selection management or refinements of the group system with gradual removal of the overwood. The latter system is the most favourable for regeneration as both the species need shade in the early stages and as it allows of the formation of closed groups of regeneration. Where Pine is to be regenerated with Beech a short regeneration period is necessary, with rapid opening at the margin of groups to encourage Pine as soon as the Beech is past the danger of frost damage. Regeneration of pure Beech demands a longer period, with more gradual removal of overwood at the margin of groups in such a manner that there is never a definite boundary between overwood and regeneration. In Beech/Silver Fir the period may be yet longer, with more numerous groups that are very slowly extended. Here the only radical difference from the selection system may be that cleanings, thinnings, opening of the canopy, regeneration, and removal of overwood proceed in logical order. Beech is very sensitive to environment, and tending operations have a marked effect on quality; hence cleanings should be frequent and light. Cleanings and thinnings should constantly improve quality and form a means of genetic improvement by securing regeneration from the best trees as seedbearers. [See also *For. Abstr.* 7 (Nos. 1750, 1780).]

23 : 12.26–8 : 24. LEIBUNDGUT, H. Über die waldbauliche Behandlung der Eiche. **[On the**

silvicultural treatment of Oak.] *Schweiz. Z. Forstw.* 96, 1945 (49–58 + plates). [G.] [1716].

(i) The need for a secondary stand of auxiliary species is stressed; for this purpose the natural associates of Oak are best, e.g. Hornbeam, Small-leaved Lime, Beech, Field Maple, etc., according to site. With Hornbeam and Lime special care is necessary to prevent undue competition with Oak in the first 15 years or so; on heavy and calcium-deficient soils Beech and Oak will keep fairly well in step, but on rich, calcareous and well aerated soils Oak must be given a good start. In the younger stages the top storey should be practically pure Oak, but in middle and old age species such as Ash, Cherry, Beech, Lime and Hornbeam should be allowed to grow into the main stand. (ii) Regeneration that appears very unpromising will often succeed: only where heavy bracken cover or grasses forming a dense mat of roots are present, is competition likely to cause failure of the Oak. Even 2 seedlings per sq. m. may be regarded as 'usable' regeneration. Special care is needed against suppression or failure at the margin of regeneration in groups (so-called *Steilrand* or 'abrupt margin'); in such cases it may be necessary to secure good gradation by cutting back taller marginal plants, or to provide a border of associate species. Early weeding and cleaning are very important. In the first few years a very light shelter of Birch, Alder or Aspen is beneficial in reducing frost; if these are absent a light admixture of Grey Alder may be planted for the same effect. Any conifers should be removed. Considerable benefit is likely from annual spraying with lime-sulphur mixture against Oak mildew, and the cost of the operation is low. Dense natural regeneration must be so treated that it is neither too whippy and subject to snow damage nor sufficiently open to allow of branchiness: at 5 years the number of seedlings should not exceed 400 per are. In the thicket stage the aim must be to cut back or remove inferior Oak saplings and those of other species from the top storey, leaving the lower storeys untouched. Data from two sample plots indicate that at this stage forks account for over 55, excessive branching 15–20, and crooked growth 13–14 per cent. of the inferior saplings. At 10–15 years the crown length of the upper-storey saplings should be almost one-half and never less than one-third of total height. Thinnings, beginning at 25–35 years, should be very careful and light at first, keeping the stand closed up to about 50 years of age, when the auxiliary stand should be about 10 m. high. Oak stems per ha. should be 400 at 50, 200 at 100, 150 at 150, and 120 at 200 years of age. As the underwood must be renewed to maintain protection of the élite stems it should be established in groups of a few ares rather than extensively. Natural Spruce near élite stems should be retained at this stage. (iii) Large areas under Oak, as in France, are not envisaged, and Oak should be grown only where the site will yield high-quality timber or where the species is needed to preserve site productivity. Frosty sites and those exposed to N. winds should be avoided. Owing to the long rotation, relatively large areas must be taken up, e.g. regeneration can begin on areas of 10–20 ares but must be progressively extended over several seed years to at least 1 ha. Owing also to the special treatment required, the Oak stands will be enclaves in areas under different treatment, but may be fitted into any type of management (most readily into Swiss refinements of the group system) if provided with a border of the auxiliary species. Purely natural regeneration of Oak is unlikely to be possible in view of the desirability of felling individual élite trees only as they reach maturity, and regeneration will probably be secured by sowings to complete such natural regeneration as may be present. [See also *For. Abstr.* 7 (No. 1725, 1727, 1749.]

23 : 12.26–8 (59.1). KERMODE, C. W. D. **Natural and artificial regeneration of Teak in Burma.** *Indian For.* 72, 1946 (15–21). [Forest Research Institute, Dehra Dun.] [1717].

After a review of the evidence on natural regeneration of Teak in Burma it is concluded that in the moist tropical forest where the best Teak grows, any system of natural regeneration which aims at producing a crop of near plantation density is inferior in results to taungya plantations and is much more costly. Natural regeneration is sometimes found in fair amount, and here operations designed to establish regeneration already present can be successfully carried out at a reasonable cost. The operations consist of improvement fellings, which are now often done at the same time as girdling. A more intensive form of work is carried out after bamboo-flowering if regeneration appears in abundance. In the drier Teak-bearing forests, natural regeneration of Teak can be established by the use of taungya. The same probably applies to moist tropical forest, but as such forest is capable of bearing a crop of plantation density, it is preferable to regenerate artificially.

All Teak plantations in Burma have for many years been made by taungya. Three years' tests with Teak seed obtained from all over Burma have shown that there is little difference in the germination of seed collected from lower and central Burma, but that seed from the more northerly divisions consistently gave poorer germination percentages. A considerable amount of experimental work has been done on stump-planting, but though early stump-planting produced markedly better first-year growth than seedlings, it has not been generally adopted, on account of the extra expense involved.

In the early nineteen-thirties there was considerable controversy on the making of plantations and a number of arguments against planting were brought forward. The most important were that beehole-borer attack was more severe than in natural forest, that considerable dying off was taking place, and that the quality of the timber was not as good as that from natural forest. Beehole-borer attack can be kept to a minimum by restricting plantations to areas of known low incidence, and by early and heavy thinnings. Dying off occurs only on sites which are now considered unsuitable for Teak plantations. The quality of timber has not yet been proved to be inferior to that of natural Teak and it is suggested that this argument may have been inspired by trade interests.

Other methods of introducing Teak artificially have been tried. (1) *Gap planting*: The tentative conclusion has been reached that this is not worth while unless gaps are available of, or could be enlarged to, 4–5 acres, and having got gaps of that size it would be far more economical to regenerate them by small taungya plantations. (2) *Bamboo flowered areas*: Experiments made since gregarious flowering began in 1935 show that broadcasting and dibbling are failures, and stump-planting of large areas with no subsequent tending is not worth while. [Cf. *For. Abstr.* 7 (Nos. 1709, 1720, 1752, 1754).]

23.1. *Natural Regeneration*

23.1 : 12.25 (485) : 21.11 : 21.31 : 12.14.3.
BJÖRKMAN, E. Studier över ljusets betydelse för föryngringens höjdtillväxt på norrländska tallhedar. [**Studies on the relation of light to the height growth of regeneration on Norrland Pine heaths.**] *Medd. Skogsförsöksanst. Stockh.* 34, 1944–45 (497–542). [Sw.sw.e.] [1718].

In connexion with the known fact that the difficulty in obtaining natural regeneration on such sites is generally due not to lack of seedlings but to factors adverse to establishment in the critical early stages, the present paper describes 3 experiments in which light was controlled at intensities between 50 and 25 per cent. of that in the open, and one experiment with trenched plots, all experiments being performed on flat heaths of a type very common in Norrland.

(*a*) Over a period of 9 summers, previously well grown Pine seedlings, on a 15-year-old clearing, gradually died when light was reduced to 25 and showed successively deteriorating growth, compared with seedlings in the open, when it was reduced to 50 per cent. of full illumination.

(*b*) Over a period of 5 summers, previously suppressed Pine seedlings that had just begun to react to open conditions, on a 5-year-old clearing, were not hampered in growth even by reduction of light to 25 per cent. On the contrary, there was a distinct etiolation effect in that the screened plants (comparable with those under natural shelterwood) showed greater height growth than seedlings in the open.

(*c*) Over a period of 5 summers, seedlings in the middle of a new 50 × 50 m. clearing reacted to reduction of light to 40 per cent. in essentially the same manner as those under (*b*). These two experiments recall the fact that young Pines with long leaders and slender stems are generally found growing in the half-shade of mixed Pine/Spruce/Birch stands which usually produce good-quality timber.

(*d*) In a trenched plot under an old closed stand, formerly suppressed seedlings showed very strong growth similar to that of those in the open, even in the first summer following root isolation by trenching, in spite of a light intensity only about 40 per cent. of that in the open. On a simultaneously trenched plot in the competition zone between 3 seedbearers that had stood for some years on an open clearing there was no appreciable growth reaction in the seedlings, even after 5 summers.

In discussion of these results, stress is laid on the ineffectiveness of full light in the presence of strong root competition. The comparative importance of moisture and nutrients is not known, but the relation between these factors is likely to be a complex one. At all events, it appears that the favourable effect of clear felling on seedling growth on such sites is to be attributed primarily to reduced root competition rather than to increased light. If only small openings are made in a stand, or where old seedbearers are left on poor, dry sites, roots may rapidly occupy all available soil space and possibly bring about some type of exhaustion, as suggested by the results obtained with trenching under old seedbearers. [Cf. *For. Abstr.* 7 (Nos. 1098, 1723, 1731).]

23.1 : 12.25 (485) : 21.32 : 11.47 : 22.11 : 12.14.3. ROMELL, L. G., and MALMSTRÖM, C. Henrik Hesselmans tallhedsförsök åren 1922–42. **[Henrik Hesselman's Pine-heath investigations, 1922–42.]** *Medd. Skogsförsöksanst. Stockh.* 34, 1944–45 (543–625). [Sw.e.] [1719].

This paper makes available some results which would have been published by Prof. Hesselman, had he lived to do so, together with other results previously published but necessary for discussion. The problem is the well known one of the failure of regeneration to become established in openings in the Pine heath forests (Pine with ground lichens) of northern Sweden. One chapter is devoted to the background of the researches, the remainder to the researches and their results.

Manuring trials were made with nitrogen as ammonium sulphate or ammonium nitrate, applied by watering once a week thoughout the summer for 13 years, the rates of application being equivalent to weekly doses of nitrogen of 8·5 and 14 kg. per ha. for the stronger and 1·7 and 2·8 kg. per ha. for the weaker solutions. The stronger solutions produced a striking growth response initially, soon followed by failure not only of Pine and Spruce seedlings but also of lichens and heather. The weaker solutions also gave promising responses but the seedlings mostly failed in the end. Heather, *Vaccinium*, etc., became luxuriant and remained so for the most part. Nitrogen deficiency is thus indicated as one cause of seedling failure, probably among several nutritional and other causes.

In experiments on the effects of clear felling and of soil cultivation by hoeing or with Kolmodin's plough, soil cultivation by either method had no noticeable effect where the old stand was left, whereas regeneration soon appeared in quantity after clear felling with no cultivation and this treatment also gave the highest density of stocking, though the number of tall seedlings was greatest on cultivated ground and growth was distinctly better on ground hoed all over than on ground mostly or wholly undisturbed. This result is believed to be due in part to a manurial effect of plant materials made available, as well as to removal of root competition and that from the ground flora.

Trenching of plots under open stands of Pine had little effect in the first few years but later proved effective in promoting establishment and growth. A plot hoed but not trenched gave negative results, in striking contrast to the heavier stocking, better growth and greater length of needles on trenched plots, whether hoed or not. Hoeing combined with trenching had a definitely favourable effect not only on growth and needle length but also on the chlorophyll and nitrogen contents of the needles, and on root and mycorrhiza development. In discussion, it is again urged that trenching not only removes root competition but also supplies fresh plant material and probably has an effect similar to that of green manuring.

In general, the results corroborate the view, now commonly held, that the degeneration of the sites in question, leading to extreme types of Pine forest with ground lichens, is due to a combination of root competition with poor litter fall, producing increasing scarcity of nutrients in the increasingly thin and acid humus layer. Such degeneration may be started by anything that causes young growth to fail in openings and tends to perpetuate the latter. Damage by *Phacidium infestans* is no doubt one of the factors. The poorer and drier the site, the greater is the danger and the more difficult is it to arrest the process.

23.1 : 12.26–8 (54:3) : 23.2. LAMBA, G. S. **Teak regeneration in the Central Provinces.** *Indian For.* 71, 1945 (346–7). [Paper read at the 6th Silvicultural Conference, Dehra Dun, 1945.] [1720].

Before 1926, Teak forests in the Central

Provinces were worked under selection-cum-improvement fellings, and the various conditions influencing natural regeneration were not clearly apparent. With the conversion to uniform method under recent working plans, the matter has been receiving considerable attention. The proportion of Teak is increasing over large areas of forest, but there are still several problems, for whose solution more knowledge is needed.

There are two main types of Teak forest in these provinces: (1) Dry type with a preponderance of Teak and often carrying pure Teak crops; (2) moist type which is more or less fully stocked and contains a large proportion of miscellaneous species. The dry type may be sub-divided into 'dry' and 'very dry'. In the 'very dry' type conditions for regeneration are poor owing to overgrazing and/or frequent fire. Many of the Teak trees in this type are past their prime and do not coppice satisfactorily. Clear fellings are not encouraged in such areas; all immature growth is being retained as far as possible and no fellings of any kind are made in the very understocked areas. The 'dry' type bears better stocked forests with a larger proportion of miscellaneous species; there is less competition from grass, and soil moisture conditions are more favourable to Teak regeneration. These forests, on being felled, give an excellent coppice crop of Teak with occasional other species. It appears that the optimum conditions for inducing advance reproduction of Teak are just that degree of cover which preserves sufficient moisture in the upper layers of the soil to enable the tender seedlings to tide over the dry season, and yet admits sufficient light to enable the seedlings to grow year after year (after dying back), and thus develop a strong root system, so that by coppicing them and clear felling the overwood, a vigorous forest of seedling coppice is produced

In the moist types of forest, where Teak is the most important species, it is known which areas are likely to regenerate successfully by natural means, and only such areas are clear felled or subjected to successive regeneration fellings. The main requisites for success are the presence of adequate advance reproduction of Teak and ample Teak in the overwood which is still capable of coppicing, sufficient soil moisture, adequate but not excessive shelter, and freedom from root competition or overhead suppression by grass, weeds, Bamboo or less valuable tree species. Valuable species other than Teak, and Bamboos are left under the Teak to assist the latter to grow straight and free from epicormic branches. As most of the other species are slower growing or less valuable than Teak, the successive cleanings and thinnings are resulting in a uniform-canopied crop with a higher percentage of Teak than the parent crop. It is now generally admitted that the presence of evergreens or semi-evergreens as a second storey under Teak is likely to prove beneficial, and in the earlier clear-felled areas where Bamboo was repeatedly cut back to let the Teak up, cutting of Bamboo has been discontinued.

Knowledge is perhaps rather more advanced on artificial regeneration of Teak, but there are a number of points on which further information is necessary, such as the best spacing, the relative advantages of pure and mixed plantations, and pre-monsoon stump planting.

It is urged that a joint tour of experts from different provinces should be arranged, covering all the Teak forests of the country, in order to compare methods, conditions and ideas. [See also *For. Abstr.* 7 (Nos. 1709, 1717, 1752, 1754).]

23.1 : 22.12 (54.87). CEYLON. **Silvicultural Research Administration, 1943.** Typescript. 1945. pp. 14. [1721].

In contrast to the ready and abundant response that has usually followed regeneration fellings in the wet evergreen high forests, results in the subtropical montane high forests and the dry mixed evergreen forests of the low country have so far been poor. Where very heavy felling resulted in almost complete opening-up of the overwood, such regeneration as occurred in montane forests appeared to be from coppice re-growth of Dambu [*Eugenia gardneri*], Kududawula [*Litsea zeylanica*], Mihiriya [*Palaquium grande*], Malweralu [*?Elaeocarpus subvillosus*] with few if any seedlings. In the dry zone, seedlings of desirable species are more numerous, but still very poor in growth. Halmilla (*Berrya ammonilla*) is the only dry-zone species which behaves in the manner of the more easily regenerated wet-zone species. In neither case, however, must cleanings be neglected after the regeneration has appeared, or nearly all is lost within a couple of years.

In the wet evergreen high forest there is heavy incidence of seedlings and larger plants of a number of species even in sections of forests in which no regeneration fellings have yet taken place. It is obvious that few of these will grow up unassisted, but evenly distributed seeding fellings and gradual raising of canopy have brought about a considerable increase of regeneration, particularly in plots which had very little of such regeneration before treatment (pp. 4–5).

23.2. *Artificial Regeneration*

23.2 (485) : 96. Redogörelse för länsjägmästareföreningens frö- och plantutredning. **[Report of the board of enquiry on seed and planting stock of the County Foresters' Association.]** *Suppl.* to *Svenska Skogsv-Fören. Tidskr.* 43, 1945. pp. 47. [Sw.] [1722].

Data for artificial regeneration in Swedish private forests show a rise from a yearly average of 25,796 ha. for 1905–09 to 40,637 for 1920–25, with a rapid decline in the late 'twenties and early 'thirties to 14,747 for 1936–40 and 12,891 for 1940–42. Too much reliance has been placed in the past on natural regeneration, and though, owing particularly to shortages of seed and labour, this method must continue to be the more extensive, a revival of artificial regeneration on a large scale is necessary for adequate re-stocking. From the rough figures available, 846,500 ha. of bare forest land and 672,900 ha. of young growth of very poor density, or together not less than 8·8 per cent. of the total forest area (not counting the Lapp country) is in need of regeneration. A review is made of the measures required, assuming the work to be spread over 20 years for the northern regions and 15 years for the remainder. At high altitudes, varying from those above 400 m. for the extreme north to 550 m. for more southerly counties, the prospects of good regeneration are very poor, and no measures are proposed. The lower-lying zones are divided into a lower and upper belt for regeneration purposes, and measures are discussed with due regard to site types and other conditions. For Norrland, Dalarna and Värmland, with a total forest area of 162,677 sq. km., direct sowing is envisaged on 6,591 sq. km. and planting on 1,823 sq. km.; the annual artificial regeneration area would then be 0·26 per cent. of the total forest area, and the annual seed requirement (at 0·95 kg. per ha. for sowings, and 0·1 for plantings) 32,220 kg., of which 21,910 would be needed for private lands. For the southern counties, with a forest area of 63,225 sq. km., the area of sowings and plantings would be approximately equal, the annual area for artificial regeneration being 654 sq. km. or 1·03 per cent. of the forest area. In this region it is intended that 10 per cent. of the regeneration should be of hardwoods, leaving the annual area to be stocked with conifers as 588 sq. km., for which the annual seed requirement (at 0·8 kg. per ha. for sowings, and 0·1 for plantings) would be 24,150 kg., of which 21,770 would be for private forests. The total annual seed requirement, not allowing for filling blanks in regeneration, thus amounts to about 56 metric tons.

A detailed examination is made of available data on seed-extraction plants, seed furnished by the County Forestry Boards and that used in their own nurseries, and existing nursery capacities. If extraction plants were evenly distributed, seeds years regular, and working possible the year round, the existing plants could produce more than the requirement of seed. As things are, the northern regions are particularly short of extraction plants, and storage facilities generally are inadequate to provide for the intervals between seed years. Cone collecting needs a great deal more organization, and nurseries should be extended to about double their present total area. The final recommendations are: (i) The country to be divided into 8 seed-supply regions, each with a permanent committee to organize seed and plant supplies. (ii) Inventory and mapping of the forests in regard to suitability for seed collection, and a uniform seed-classification scheme to be established. (iii) An artificial regeneration programme for every county, to be made up in collaboration with the Forestry Board and the State Forestry Research Institute. (iv) Proper organization of seed-extraction facilities, particularly extension of plants in the northern counties. (v) A programme for the supply of planting stock. (vi) A State loan, provisionally estimated at 500,000 Kr., to the County Forestry Boards to create reserves of seed and plants, repayment to be made from sales. (vii) Intensified study of regeneration methods and instruction in methods that have proved reliable. (viii) Co-ordination of work in forest tree breeding, in which the County Forestry Boards should also take a direct interest. Possible formation of élite seed plantations.

A special report is appended on the problems of the southernmost counties, with chief reference to the rôle of hardwoods [cf. *For. Abstr.* 7 (No. 1781)] and the need for more effective legal protection against (*a*) grazing by domestic animals, elk, deer, etc.; (*b*) replacement of valuable hardwoods on good hardwood sites; (*c*) improper treatment of middle-aged stands from the point of view of regeneration.

23.2 : 12.25 (485) : 23.13. HEDEMANN-GADE, E. När och hur böra vi skogsodla i Stockholms län? **[When and how should artificial regeneration be undertaken in the county of Stockholm?]** *Svenska SkogsvFören. Tidskr.* 43, 1945 (488–97). [Sw.] [1723].

On the easier sites natural regeneration may be obtained after cultivation by baring seed patches 40 × 40 cm. and spaced 1·3 m. apart, or on larger areas either with the 'forest sow' (a crude harrow made from a log with projecting branch stubs) or proper ploughs and harrows obtainable on free loan from the County Forestry Board. The majority of sites, however, demand artificial regeneration, owing to weed and grass competition and early summer drought. Sowing experiments showed that spring sowings of Pine and Spruce must be made immediately after the soil thaws or else in mid-June, and where precipitation in the spring months is normally less than 30 mm., the latter time is better. Autumn sowings as late as the end of October or the beginning of November often gave results as good as those of early spring sowings. Deep loosening of the soil was most important on the worse site qualities and had less effect on Pine than on Spruce. On the whole, sowings have been disappointing but plantings will succeed under the right conditions, which have been summarized by the author in a previous paper. [Cf. *For. Abstr.* 7 (Nos. 1174, 1718–9, 1731).]

23.2 : 12.26–8 : 11.47.21 : 21 : 31.0. RECKE, GRAF V.D. Versuche mit der Akazie. **[Trials with *Robinia pseudoacacia*.]** *Forstarchiv* 20, 1944 (61–3). [G.] [1724].

The varied uses of False Acacia wood, which is very hard and durable, are emphasized. The flowers are a good source of nectar for bees. On medium-quality Pine sites the species grows about twice as fast as Pine. It has no important diseases or pests, though rabbits, hares and deer are fond of it for browsing. The seeds are attacked by flea-beetles, but these can be destroyed by treating seedbeds with wood ashes. Frost is the main danger, hence the use of local provenances and measures to promote early growth are desirable.

Seed scarification by Peneff's method [cf. *For. Abstr.* 4 (26, 102)] improved both the plant per cent. and height growth, but treatment of seed with inoculum prepared from root nodules had no worth-while effect.

In planting trials, root cuttings proved unsuitable as a means of propagation. The best combination of conditions was clean cultivation of the site, use of root suckers or 2-year seedling stock, cutting back immediately after planting, and inoculation of planting pits (not surface inoculation) with soil from existing stands of the same species. As the species is a calcophile, the best results would probably demand liming, for which marble meal at rates of 20 Doppelzentner per ha. or 0·25 kg. per planting pit are recommended.

23.2 : 12.26–8 : 24 : 12.19. BURGER, H. Über die künstliche Begründung von Eichenbeständen. **[The artificial establishment of Oak stands.]** *Repr.* from *Mitt. schweiz. Anst. forstl. Versuchsw.* 23 (2), 1944 (282–373). [G.g.f.] [1725].

Of Swiss Oak associations the most important economically is the *Querceto-Carpinetum*, divided into sub-associations (*a*) with Pedunculate Oak on the more fertile, heavier and less aerated soils, with a range of types from those with *Alnus glutinosa* to transitions to (*b*) Sessile Oak communities on drier, better aerated soils, ending in transitions to Pine forest. A table of diagnostic features is given for Pedunculate and Sessile Oaks, which show nice site preferences and must be distinguished silviculturally; important racial differences occur in foliation, leaf fall and height growth.

Nursery practice: Isolated seedbearers produce fertile acorns at 40, coppice growth as early as 5, but closed stands only in sufficient quantity at 80–90 years of age. Only ripe acorns from the best stands on dry ground should be collected. Acorns retain their viability, with simple storage methods, only until the succeeding spring. Pedunculate is less liable than Sessile Oak to premature autumn germination. Storage in wire netting or crates placed on forest soil and covered with litter, or in a cool cellar with natural soil, is recommended. Satisfactory germination, under Swiss conditions, is that giving plant percents of 60 for Pedunculate and 40 for Sessile Oak. Autumn sowings of seed treated with red lead or zinc phosphide have given the best results, but spring sowings may be recommended for wet and frosty sites, or where acorns are likely to be eaten by animals. Drills should be spaced 20 cm. apart for 1- to 2-year and 30 cm. for 3- to 5-year seedlings. Depth of sowing: larger acorns 5–8, smaller 4–6 cm., according to soil and season. Density: 30–60 acorns per m. for Pedunculate, 40–60 for Sessile Oak. Root pruning is advisable, before sowing if seeds are pre-germinated, at 10 cm. depth *in situ* during the first summer, or when lifting 1-year stock, which should stand as transplants for 1–4 years.

Establishment of stands: Natural regeneration is desirable where parent stands are present, but needs proper preparation and removal of the old stand. For artificial regeneration, direct sowing gives undisturbed root development and generally denser stands, but success is less certain than with plantings and the method is restricted by the incidence of mast years. 1- to 2-year seedlings gave the best results, though 3- to 5-year root-pruned transplants were good on weedy sites. 1- to 2-year wildings can be used, if not taken from excessive shade and if put out under light shelter. Two persons can notch-plant 50–80 but hole-plant only 20–30 plants per hour; correctly notched plants thrive better than those that are hole-planted.

Long-term planning must be based on the production of quality timber and must take account of ecological conditions, e.g. natural associates—Elm, Maple, Cherry and Alder for Pedunculate Oak, Small-leaved Lime, Beech, Birch and Pine for Sessile Oak.

Young stands, whether natural or artificial, need constant attention. In weeding and cleaning it is usually enough to maintain a pure Oak overstorey with free tops. Understoreys of auxiliary species must be maintained, especially as cleanings to strengthen the saplings against snow damage would otherwise bring the risk of epicormic formation. Damage by various agencies varies by species and race with dates of foliation and leaf-fall, height growth, etc. The mean height of the Oak overstorey is relatively little greater than that of the understorey, whereas its mean diameter is always 50–100 per cent. greater, indicating that young Oak in danger of suppression from neighbours concentrate upon height growth. Straight stem growth in young Oak is comparatively rare; Pedunculate is less liable to fork and has rather straighter growth than Sessile Oak; stem form is worse in the lower than in the upper storey; and side shade may cause poor stem form. Under like conditions, Pedunculate is more inclined than Sessile Oak to form epicormics but shows better natural pruning. [See also *For. Abstr.* 7 (Nos. 1716, 1749).]

23.2 : 12.26–8. BURGER, H. La création de peuplements de chêne. **[The formation of Oak stands.]** *J. for. suisse* 96, 1945 (6–12, 28–34). [F.] [1726].

See preceding abstract.

23.2 : 12.26–8 (494). BRODBECK, C. Eichennachzucht. **[Oak cultivation.]** *Schweiz. Z. Forstw.* 97, 1946 (48–51). [G.] [1727].

Despite considerable research on Oak cultivation, practical application of the results is not likely to be made in communal, corporation or private forests unless old prejudices—in particular the belief that Oak is unprofitable as a crop—are broken down. It is believed that natural habitats of Oak/Hornbeam mixed deciduous forest in Switzerland total about 100,000 ha. To maintain this area on a 200-year rotation would require the regeneration of at least 500 ha. per annum; in fact, however, this required regeneration area would be a bare minimum in view of past neglect. Oak regeneration in the last 5 years can scarcely have amounted to 100 ha. annually. The problem should be tackled by a publicity campaign, by some practical organization for the procurement of seeds and plants (including wildings) and preferably by forming an association for Oak cultivation which would attend to questions of supply and enable experience to be exchanged.

23.22. Preparatory Work. Auxiliary Measures

23.22.1 : 07.7. TIRÉN, L. Traktorn och skogsodlingsfrågan. **[The tractor and the problem of artificial regeneration.]** *Skogen* 33, 1946 (21–4). [Sw.] [1728].

Preliminary trials have been made, on large felling sites in Norrland, of soil cultivation with 3 types of tractor (Munktells 3·6-ton; Allis-Chalmers 5·5-ton; Lanz Bulldog 5·0-ton) pulling special chain-trailed implements. None of the tractors was entirely suited to this kind of work, for which the following points in design are believed to be desirable:—Weight about 4 tons; width between tracks 120–130 cm.; high clearance; covering the underside of the chassis with a steel belly; extra-stout, easily repairable tracks, heavier springs, and no mudguards; provision of winch equipment. Each of the cultivators, trailed one behind the other, consists of an iron body with 8 exchangeable iron claws radiating star-wise therefrom. The first, designed to tear up shrubs and smaller obstacles in general, weighs 180 kg. and has claws 40–45 cm. long, at right angles to the body; the second, intended to bare the mineral soil, weighs 165 kg. and has claws 35–40 cm. long and directed slightly forward. The rear implement has a chain 'tail', used for steering and twisting free of snags. The actual work of cultivation is done normally by two claws at a time, leaving sowing strips 20–30 cm. wide and up to several metres long: these are not evenly distributed over the area and hand cultivation might be needed on difficult sites to complete the work. A tentative estimate of total costs, including amortization of equipment and sowing (though the latter was not actually included in the study), based on a performance of 8 ha. per 7-hour day, amounts to 46 kr. per ha., as against 140 kr. per ha. for manual cultivation of sowing strips.

23.22.1 : 07.7. FROMSEJER, K. Fromsejers dobbelte Rende- og Undergrundsplov. **[Fromsejer's double ridge and subsoil plough.]** *Dansk Skovforen. Tidsskr.* 30, 1945 (555–6). [Dan.] [1729].

The plough described and figured was designed for use with a tractor to prepare lean field soils for planting. The subsoiling attachment can be set to a maximum depth of 30 cm. A 50-cm. furrow is cut and the soil turned to both sides by two opposite mouldboards, which are 65 cm. long and have a strong outward sweep. The plough is manufactured by the Bovlund Plovfabrik, Branderup, and has been approved by the Forest Implements Committee. Where the hardpan is not too deep, it gives very good results.

23.22.1 : 11.41 : 11.42 : 44.1 : 07.7. GANTIMUROV, I. I., and OSIN, D. D. Vliyanie obrabotki pochvȳ pod lesnȳe kul'turȳ na ee lesorastitel'nye svoystva. **[The influence of cultivating the soil in forest plantations upon its properties in relation to forest growth.]** *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* No. 24, 1941 (129–59). [Russ.] [1730].

(i) *Ridge Plough* (*with two mouldboards*): The chief disadvantage of this implement, which is therefore considered unsuitable for podzolized soils, is that the A horizon, which is the richest in nutrients, is cut away and turned aside; thus planting is done in the lower part of the A or even in the A_2 horizon. Most species of the central and northern zones of the U.S.S.R., e.g. Pine, Spruce, Birch, Oak, Silver Fir, Larch, Lime and Norway Maple, grow feebly when planted in the podzol horizon. On gleyed sandy podzols, the available phosphate and potash in the central ridge formed in the furrows were in all cases much poorer than in the soil turned aside by the plough. In composting experiments, the furrow soils showed poor or non-existent nitrification and ammonification, whereas the turned topsoil showed accumulation of nitrate and ammonia: this difference was especially evident for a strongly podzolized clay-loam, and in the same soil low permeability to water caused waterlogging of the furrows. Prolific weed growth appeared in the furrows.

(ii) *Cultivators* of two types (spring and shuffler), used to work the bottoms of the furrows made by (i), were unsatisfactory, particularly on heavy, podzolized clay-loams.

(iii) *Spiral Cultivator* (*Fräse type*): This implement forms a broad furrow with a central ridge up to 20 cm. high and consisting of well mixed, loose soil and pieces of sod (where the latter is present). Texture was good, plant remains decomposed well, and nitrification was greatly improved particularly if the ground was open. There was little weed growth. Of all the methods tried, this gave the best all-round results.

(iv) *Three-furrow Plough* (*tractor-drawn*; *followed by disking*): This gives a fully cultivated layer equal to that obtained in agriculture. Comparison of spring and summer soil samples suggested that the luxuriant weed growth which developed took up all the soluble nitrogen. Results otherwise were good, but weed growth would have to be kept down. A disadvantage is that a larger area is cultivated than is necessary for development of the planting stock.

(v) *Nutrients*: On podzolic soils, in the year following cultivation, there was considerable mobilization of all soluble nutrients in open ground, but less under canopy. Nitrate anions were associated chiefly with calcium. Water-soluble magnesium was present in quantities difficult to determine. Both in natural and composted soils ammonification and nitrification proceeded rapidly in the disturbed topsoil, whereas in unworked soil or in the podzol horizon these processes were slow or absent and available nutrients poor.

23.22.1 : 12.25 (43.1–5) : 23.2 : 44.1. KRAHL-URBAN, J. Kiefernkulturversuchsflächen aus polnischer Zeit im Forstamt Schönfeld (Wartheland). **[Experimental plots for artificial regeneration of Pine, established in Polish times in the Schönfeld forest district (Wartheland).]** *Forstarchiv* 20, 1944 (45–58). [G.] [1731].

Two experimental plots, established in 1935 to study artificial regeneration of Pine and especially the effects of initial soil cultivation, were examined in 1941.

(i) *On moraine loam-sand; site quality I for Pine*: Here 5 different methods of cultivation had no considerable effect on height growth; survival, however, was best in ridge plantings, intermediate plantings on raised dug strips and mound plantings with or without loosening of the underlying soil, and worst on pared strips. On the whole, establishment costs decreased in the same order, but subsequent tending costs varied little, except for the pared strips, where they were about double those for the remainder. On such sites the essential appears to be to eliminate weed competition, for which clean cultivation is best and, where mechanization is possible, cheapest; failing this, as in the present instance, the alternative is some form of raised planting.

(ii) *On valley sands; site quality IV for Pine* (pre-occupation data incomplete): (*a*) *Sowings*—Different methods of soil preparation had no great effect upon height growth, except that clean-cultivated portions were considerably inferior to the rest. In percentage of survival on flat dug strips, over 80 occurred on unloosened and loosened ploughed strips, 66 on raised ploughed strips, 64 on pared strips, 56 on raised dug strips and 47 with clean cultivation. In general, greater disturbance of the soil gave the poorer results, possibly pointing to the (unknown) sowing season in combination with drought as the primary causes of these effects. (*b*) *Plantings*—There was little difference between the results of two forms of notching, nor was there a clear relationship between soil cultivation and survival. Height growth showed a small average difference in favour of clean cultivation, raised dug strips, ordinary dug strips and loosened ploughed strips as against unloosened ploughed strips and pared ones. Plantings were greatly superior to sowings in height growth and uniform closure: sowings, in spite of their much higher numerical stocking (which would have been still greater but for severe attacks of leaf-cast) were gappy.

Results from both site types confirm the paramount importance of eliminating competition from weeds. [See also *For. Abstr.* 7 (Nos. 1718–9, 1723).]

23.22.2 (54.7). GARLAND, E. A. **Experiments in alternating husbandry in Sind.** *Indian Fmg.* 5, 1944 (495–8 + plates). [Forest Department, Sind.] O.R.E. [1732].

A method for conserving soil fertility and ensuring fuel supplies by sowing tree seeds in lines 33–44 ft. apart, along with an arable crop such as cotton or *bajri*. Cultivation between the lines of young saplings may continue profitably for about 5–7 years, but as the shade from the trees gradually closes over the intervening cultivated strips, these are turned down to fodder grasses for 6–8 years until the trees are ready for felling. The whole process is then repeated. Babul (*Acacia arabica*) is a particularly suitable species for intercropping with grass or agricultural crops. It is an economically desirable tree, grows quickly, does not throw too dense a shade, and improves soil conditions. Experiments with the type of alternating husbandry described in this paper have been particularly successful in Sind and it is suggested that this and similar techniques should be tried out in other areas.

23.22.2 (54.7). SIND. **Annual administration report of the Sind Forest Department for the year 1943–44.** Govt. Press, Karachi. 1945. pp. viii + 21. [1733].

Apart from irrigated plantation areas, agri-silvicultural operations continued to expand and as both forest subordinates and cultivators become more accustomed to this work, results are improving. Good tree strips are now practically assured with hot-weather cultivation; success is not yet so widespread with cold-weather cultivation, but it is expected that this technique too will soon be mastered. The total area cultivated in 1944 was 41,808 acres, or some 6 per cent. of the forest estate. This systematic agri-silviculture is the most important development in Sind forestry since working plans were drawn up more than 50 years ago (pp. 3–4).

23.22.2 : 12.26–8 (54.2). Kanjilal, P. C. **Sal taungya in the Gorakhpur Forest Division, U.P.** *Indian For.* 71, 1945 (350–4). [1734].

The writer discusses in some detail the technique of Sal taungya advocated by M. Z. Huq. [see *For. Abstr.* 7 (Nos. 1169, 1170)] and particularly criticizes some of the assumptions upon which his argument rests. The old and new techniques are now being tested under comparable conditions and it is hoped that sufficient data will soon be available on which to form definite conclusions.

23.22.2 : 12.26–8 (54.2). Huq, M. Z. **Sal taungya in Gorakhpur Division, United Provinces.** *Indian For.* 71, 1945 (433–5). [Dehra Dun Forest Division.] [1735].

A further reply by the initiator of the new technique to criticism of his original article [cf. *For. Abstr.* 7 (Nos. 1169, 1170].]

23.22.2 : 12.26–8 (728.2). British Honduras. **Report of the Forest Department for the year ended 31st December, 1944.** Govt. Printer. 1945. pp. [13]. [1736].

Ten acres of Mahogany taungya were made in British Honduras in 1944. Maize and Mahogany seed were sown, the latter at a spacing of 10 × 10 ft. with 2 seeds per peg. Later the plants were removed from pegs with two seedlings, to fill blanks. This gave 76·7 per cent. of establishment and the remaining blanks were filled from a flying nursery to give full stocking by the end of the year. The costs were as follows:—

Felling 10 acres and clearing fire lines	$89.20
Sowing, bending, reaping and storing corn	71.75
Pegging, sowing, transplanting, cleaning Mahogany and cost of flying nursery of 1,000 seedlings	100.38
Total cost of 10 acres taungya .	$261.33
Yield of corn	Cwts 134⅔

The value of corn varies from $2 to $6 per cwt. according to the time of year. These figures show that the whole cost of the first year's establishment of the Mahogany crop has been more than paid for by the maize crop alone (p. 4).

23.23. Sowings

23.23.1. *Seed Procurement, Treatment, and Testing*

23.23.1 (494). Maturité des graines, temps de la récolte et manière de procéder à celle-ci pour nos principales essences forestières. **[Period of ripening, date and manner of harvesting of seeds of our principal forest species.]** *J. for. suisse* 96, 1945 (224–5). [F.] [Institut fédéral de recherches forestières.] [1737].

Information on the date of ripening, date and manner of harvesting, is given in tabular form for the following species: Alder, Birch, Cherry, Hornbeam, Oak, Sycamore, Plane, Ash, Beech, Elm, Lime, Aspen, *Pinus cembra*, Spruce, Larch, Scots Pine, Silver Fir.

23.23.1 : 12.25. Wright, J. W. **Influence of size and portion of cone on seed weight in Eastern White Pine.** *J. For.* 43, 1945 (817–9). [Purdue Univ., W. Lafayette, Ind.] [1738].

Cones were collected from 6 Eastern White Pine trees (*Pinus strobus*), and the seeds extracted. It was found that the fresh weight of the seed increases significantly in progressing from small to large cones and from the apex to the base of the cone. There were significant differences in seed weight between trees. There was no obvious correlation between seed or cone size and the age, diameter, or growth rate of the parent. The sorting of seeds according to portion and size of cone and tree may be effectively used to reduce the number of seeds which it is necessary to handle in order to obtain a seed sample with an average weight of a given accuracy. *Author's summary.*

23.23.11 (485) : 21.8. Tirén, L. Skogsträdens fruktsättning år 1944. Skogsträdens fruktsättning år 1945. **[Fruit-setting of forest trees, 1944 and 1945.]** *Flygbl. Skogsförsöksanst., Stockh.* Nos. 58, 59. pp. 12 + 12. [Sw.] [1739].

Two standard pamphlets, giving information (chiefly in map form), for the two years in question, on flowering conditions and seed-crop prospects for Pine, Spruce, Birch, Oak and Beech in Sweden.

23.23.13 : 12.25 : 07.7. Frédou, C. La préparation des graines de résineux: un nouveau modèle de sécherie. **[The preparation of coniferous seed: a new design for a drying**

apparatus.] *Rev. Eaux For.* 83, 1945 (641–55 + plates). [F.] [1740].

Description with diagrams and photographs, of an apparatus for the extraction of seed from cones, designed and manufactured by the firm of Nessi frères of Montrouge in two models, one portable and the other stationary. The heating unit is designed to burn cones after the seed has been extracted, but can easily be adapted to burn wood. The hot air, which circulates in the drier proper, is thermostatically controlled. The larger model holds about 70 kg. of cones, the smaller one 20–25 kg.; the length of time the cones have to be in the drier varies from 5 to 8 hours; the cost of these two models is 65,000 fr. and 36,500 fr. respectively.

23.23.13 : 12.25. LEBARRON, R. K., and ROE, E. I. **Hastening the extraction of Jack Pine seeds.** *J. For.* 43, 1945 (820–1). [Lake States Forest Exp. Sta., St. Paul, Minn.] [1741].

It has been the general custom at the conifer-seed extractories in the Lake States to dry Jack Pine (*Pinus banksiana*) cones for 6–8 hours at a relatively high temperature (about 170° F.). The authors of this article found that equally good results were obtained by drying cones of this species for 2 or 3 hours at temperatures of 140–150° F. It is not generally understood that Jack Pine seed can escape from the cones when the scales are only partly separated. In fact almost all the seed can be shaken out when the scales have separated only ⅛ to ¼ inch. Probably the 7-hour drying schedule in use was based on the desire to obtain a degree of recurving in the scales which is, in fact, unnecessary.

23.23.15. Aufbewahren von Saatgut. Conservation des semences. **[Seed storage.]** *Suppls.* to *Schweiz. Z. Forstw.* 97, 1946. pp. 4 + 4. [G.F.] [1742].

Recommended storage practices are tabulated by species, for seed of all the important Swiss trees, in separate German and French versions.

23.23.15 : 12.25. NEW ZEALAND. **State Forest Service: annual report of the Director of Forestry for the year ended 31st March, 1945.** Govt. Printer, Wellington. 1945. pp. 35. [1743].

Seed stored according to a project begun in 1941 has been tested during the year and results so far indicate that for indigenous New Zealand species such as Kauri (*Agathis australis*) and Kahikatea (*Podocarpus dacrydioides*), storage for any length of time must be at 10–15° F., preferably sealed. Kauri seed never germinates as well after storage as it does when fresh, and stratification seems to be deleterious. On the other hand, stratification increases speed of germination in all exotic species studied, *Pinus strobus, P. laricio, P. contorta, Pseudotsuga taxifolia* (p. 7).

23.23.15 : 12.26–8. AFANASIEV, M. **A study of dormancy and germination of seeds of *Cercis canadensis.*** *J. agric. Res.* 69, 1944 (405–20). [Oklahoma Agricultural Exp. Sta.] O.R.E. [1744].

Delayed germination of seed of Redbud (*Cercis canadensis*) is caused by the impermeability of the seed coat to water and by the dormancy of the embryo. The seed coat can be rendered permeable to water by any of the standard treatments used with hard-coated seeds; namely soaking of seed in concentrated sulphuric acid, hot water or boiling water bath, and mechanical scarification. The optimum treatment with sulphuric acid was of 30–35 minutes' duration. Extension of the storage of ripe dormant (unstratified) seeds to 15 months resulted in the lengthening of the required period of acid treatment to 45 minutes. Stratification of acid-treated seed at low temperature (35–45° F.) for 5 to 8 weeks was found to be effective in after-ripening. Holding after-ripened seed in pure oxygen for 24–48 hours resulted in a marked increase in the rate of germination. The optimum germination temperature of after-ripened Redbud seed was 70° F. *From author's summary.*

23.23.15 : 12.26–8. PATON, R. R. **Storage of Tuliptree seed.** *J. For.* 43, 1945 (764–5). [Ohio Agricultural Exp. Sta.] [1745].

There seems to be no reference in the literature to the possibility of storing Tuliptree (*Liriodendron tulipifera*) seed for more than one season, though the occurrence of poor seed years makes this highly desirable. A successful experiment has recently been carried out at the State Forest Nursery at Marietta, Ohio, in storing seed in pits out of doors. A large quantity of seed was collected in the autumn of 1941 and stratified in a pit in sandy soil. The pit was about 30 in. deep, 30–36 in. wide, and long enough to accommodate all the seed collected (6,000 lb. dry weight). The seed was placed in the pit in layers about 2 in. thick, alternating with layers of sand just deep enough to cover the seed, with a top layer of sand about 10 in. deep. The seed is removed by taking a vertical section from the pit, from the top to the bottom across the full width of the pit and then longitudinally until sufficient seed is obtained for the current sowing.

The seed has been the source of supply for all subsequent sowing at the nursery, and in the 4th year (spring of 1945) showed as good germination and viability as when originally stored. A cutting test in the spring of 1945 on 4,000 seeds showed 15 viable seeds per 100, and 275 viable seeds per quart of mixed seed and sand as they come from the pit. Actual germination in the seedbeds has been excellent.

23.23.19 : 12.25. Ullén, G. En genväg för bedömning av barrträdsfrös grobarhet. **[A short cut for determining the viability of conifer seeds.]** *Skogen* 33, 1946 (67–8). [Sw.] [1746].

Haller and Julius' textbook of forestry (1908) mentions three rapid methods of assessing viability, viz., crushing against white paper, when viable seeds leave an oily spot; cutting and inspecting for soundness; and laying the seed on a redhot iron plate, when viable seeds explode.

The author has tested the crushing method in comparison with the normal methods involving actual germination over a period of days, and has found it reasonably reliable for Spruce seed, the difference from results by standard methods being usually no more than about 3 per cent. The crushing method would therefore be useful in cases where time is too short to employ standard methods. It is probably also applicable to Pine seed.

23.23.19 : 12.25 (485). Tirén, L. Granfröets grobarhet i södra och mellersta Sverige. **[Viability of Spruce seed in southern and central Sweden.]** *Skogen* 33, 1946 (50). [Sw.] [1747].

Includes a tabular statement of germination per cent. after 10 days and yield expressed as kg./hl. for seed collected in autumn 1945 in 16 southern and central counties of Sweden. Yield and 1,000-seed weight were low, owing to the presence of much empty seed and the prevalence of insect damage.

23.23.19 : 12.25 (485). Tirén, L. Tallfröets grobarhet i Norrland. **[Viability of Pine seed in Norrland.]** *Skogen* 33, 1946 (7). [Sw.] [1748].

Preliminary data for seed yield, 1,000-seed weight and germination per cent. after 10 days, are tabulated by latitude and altitude. Viability of about 50 per cent. may be expected for seed collected up to 550 m. altitude at 60–61·9° N., 500 m. at 62–63·9° and 425 m. at 64–66·9°. Above these limits, stands with large, well developed cones may give comparable results. Cones 2·5 cm. or less in length should be avoided.

23.23.3. *Methods of Sowing*

23.23.3 : 12.26–8 : 12.11.21 : 55. Krahl-Urban, J. Frühjahrs- oder Herbstsaaten der Eiche? **[Spring or autumn sowing of Oak?]** *Forstarchiv* 20, 1944 (64–7). [G.] [1749].

Since jays thieved more than 50 per cent. of the acorns sown in an experiment begun at Freienwalde in autumn 1940, the results are confined to height measurements, which, however, are sufficient to show that in the first three years of growth the mean height of autumn-sown was always at least 33 per cent. greater (averaged means of all series) than that of spring-sown stock. For a series from seed of 85-year-old trees the superiority of autumn-sown plants was about 80 and 65 per cent. in the first and second growing seasons respectively. In the second year one-third or more of the autumn-sown, but only 9–17 per cent. of the spring-sown stock, was 20–50 cm. high. Autumn sowings, however, have disadvantages, especially damage by animals (e.g. mice, boars, jays) and losses from extremely cold winters. With spring sowings, particularly late ones, the danger period is shorter, and on the whole, spring sowings are still to be preferred except in the nursery, where special measures can be taken.

The material is not sufficient to give unequivocal proof of the influence of age of parent tree on growth of progeny, but there were considerable average differences, in both seasons and both types of planting, in favour of the progeny of 85-year-old trees as against that of 40-year-old trees and those more than 300 years old. Of the two latter, progeny of 40-year-old trees was slightly inferior in height growth. Without, therefore, condemning young or old trees as sources of seed, it seems advisable to concentrate upon middle-aged stands for preparatory fellings and for seed collection in the rare mast years. It may also be worth while, in the interests of more uniform growth, to separate acorns from parents of different age when making sowings. [See also *For. Abstr.* 7 (Nos. 1716, 1725–7).]

23.24. Formation of Stands by Planting

23.24 : 12.26–8 (494) : 23.5 : 12.25 : 42 : 44.3 : 45.12. JAGER, L. Das Wiedereinbringen der Buche in die Nadelholzbestände des Forstbezirkes St. Gallen. [**The re-introduction of Beech into the coniferous stands of the St. Gallen forest circle.**] *Schweiz. Z. Forstw.* 96, 1945 (39–45). [G.] [1750].

An opportunity for a return to hardwood admixtures was provided by extensive windthrow and snow damage in 1919 and the succeeding years. The number of hardwood (chiefly Beech) seedlings planted out in public forests rose from 7 and 10 per cent. of total plantings in 1900–09 and 1910–19 to 32 and 48 per cent. in 1920–29 and 1930–39. The large demand for Beech seedlings was met partly by the establishment of temporary nurseries. Much use was made of wildings, the smaller ones being grown on in nurseries and the larger (40–60 cm.) planted out direct. Mortality of such stock was low if lifting and planting were carefully done in normal weather, and wilding stock, being accustomed to shade and drip, proved more adaptable than nursery stock and also suffered less from deer browsing. Both pit planting and notching were used in planting out; the former, though slower, gave better results in dry weather and with late plantings. Two types of planting have been made: (*a*) to establish mixtures of conifers and hardwoods in groups of about 50 (and later up to 400) plants on large areas cleared by storm and snow damage; and (*b*) underplanting of Beech in pure conifer stands of middle age onwards that had a reduced density in consequence of damage by storms and disease, such plantings being made by groups or strips where most needed. In general, results for both types of planting have been good and the underplantings continue. Beech has already improved the humus layer on the heavier clay-loams and in Spruce stands suffering from *Armillaria mellea* the attacks of the fungus appear to have been reduced to a minimum. The chief dangers to the young Beech plantations are early or late snow falls (as the plants still need strengthening by cleanings and opening of the overwood) and deer browsing, which has been less serious in recent years. The costs of establishing the plantations are regarded as reasonable. [See also *For. Abstr.* 7 (Nos. 1715, 1780).]

23.24 : 12.26–8 : 11.49.5 : 45 : 11.47.2. LALLEMAND. Les plantations de peupliers en Chautagne. [**The Poplar plantations in Chautagne.**] *Bull. Soc. for. Franche-Comté* 25, 1945 (316–22 + plates). [F.] [1751].

An account of plantations made on the marsh of Chautagne in the Rhone valley for the purpose of rehabilitating degraded land. The land was first drained by main canals running parallel to one another with a herring-bone system of secondary canals. All vegetation was cut and burnt before planting out nursery stock of × *Populus robusta.* After planting was complete, shallow tertiary drainage channels were dug between every second pair of rows of trees, and the sods taken from them were piled at the foot of each tree, making a mound about 0·50 m. high and 1 m. square at the base.

Results were, on the whole, satisfactory, particularly on deep peat soils. Growth was, however, checked on patches of clay soils. The cause of this seems to be the lack of assimilable nitrogen in such soil, as the application of 100 gr. of nitrates to each tree had excellent results. *Alnus glutinosa* seems to do much better on such soils, probably because of mycorrhizal activity.

These Poplar plantations are much exposed to danger of fire; the marshy land bears abundant vegetation which dies at the first frost and constitutes a serious fire hazard, and in the peat areas the soil sometimes burns to a depth of 1 m. and the fire may last for weeks. Great damage was done to young plantations during hard winters by Field Voles, which eat the cambium up to the collar. Mortality from this cause may amount to 30 per cent. of a stand. Poison was tried against this pest, but without much success. The best remedy, when it is possible, is flooding.

Saperda carcharias attacks many trees, particularly when they attain a girth of 0·15 m. In a large plantation it is considered that only biological control is practicable, and it is recommended that birds, especially Woodpeckers, should be encouraged by the provision of nesting boxes. Woodpeckers destroy up to 50 per cent. of the larvae and the wounds they make in the trees are insignificant and soon heal.

23.24 : 12.26–8 (54.2). Nicholson, J. W. **Teak regeneration in Orissa.** *Indian For.* 71, 1945 (365–7). [Paper read at the 6th Silvicultural Conference, Dehra Dun, 1945.] [1752].

Teak occurs naturally in some parts of Orissa but is of poor quality owing to dryness of climate and poor soil. About 60 years ago a few Teak plantations were formed in dry-type forests in the divisions of Angul and Puri. The Teak produced is mainly quality III or IV but the crops are of far greater value than the indigenous forest they replaced. Plantations are apt to suffer damage from cyclones, and the method recently followed in the province is to concentrate on interplanting Teak in *Bambusa* forest. This method has been very successful and very cheap. Planting is done before the flowering of the Bamboos.

The working plan is now under revision. The area of *Bambusa* forest is limited and in any case is due to flower soon. In the oldest Teak plantations natural regeneration has been profuse. It has been decided that it will be more profitable to go in for interplanting with the object of introducing Teak where no valuable species grow at present, since there is every indication that Teak regeneration will follow over all the area interplanted. In the revised plan there will be a prescription to interplant one-fifth of each selection coupe with Teak, where the soil is suitable, and elsewhere with other valuable species, the felling cycle being 20 years. Planting will normally be done just before main fellings begin, and the necessary cleanings and girdling of the overwood will be done 2 years later when fellings are complete. If flowering occurs in *Bambusa* forest, however, all planting activities will be concentrated on interplanting in such forest. [See also *For. Abstr.* 7 (Nos. 1709, 1717, 1720, 1754).]

23.24 (73). Stevens, T. D. **Forest trees and shrubs: what, where, how to plant.** *Ext. Bull. Mich. St. Coll.* No. 264, 1944. pp. 12. [1753].

A leaflet for the instruction of farmers and others likely to plant trees. There are sections on choice of species, size and age of planting stock, care of trees on arrival, soil preparation, planting methods.

23.24.1. *Planting Material*

23.24.1 : 12.26–8 (54.3) : 56.01. **Effect of diameter of Teak stump on survival percentage and early height growth. (Hoshangabad division, Central Provinces, Bori special Teak working circle.)** *Indian For.* 71, 1945 (329–31). [1754].

An account of two experiments carried out in the Bori forests on the effect of the diameter of Teak stumps on survival percentage and height growth. They confirm the results of the original experiments in Madras (1938). The results of the first experiment are shown in the following table:—

Diameter of stump in inches	*Survival per cent.*		*Mean height growth in inches*	
	1943	1944	1943	1944
0·3–0·4	79	76	5·2	29·0
0·4–0·5	86	82	7·5	38·4
0·5–0·6	84	81	9·5	45·7
0·6–0·7	93	89	11·1	50·3
0·7–0·8	95	91	12·5	50·2

The experiments need confirmation by repetition, but they give a definite indication that under Bori conditions it is not worth while to use stumps as small as 0·3–0·4 in. diameter, and better not to use those of 0·4–0·5 in. diameter if larger sizes are available. [Cf. *For. Abstr.* 7 (Nos. 1709, 1717, 1720, 1752).]

23.24.1 : 12.26–8. Dabral, S. N. **Stump planting of *Prosopis juliflora*.** *Indian For.* 72, 1946 (21–2). [Forest Research Institute, Dehra Dun.] [1755].

The study here reported was made for the purpose of comparing stump planting and transplanting of *Prosopis* species in the climate of Dehra Dun. Planting was done in the last week in July, and in early October (at the end of the rains) the survivals were enumerated and measured for height. Of 50 stumps and 50 transplants of *P. juliflora* the survivals were 4 and 78 per cent. respectively and mean height increment 3·5 and 4·3 ins. Out of 300 *P. glandulosa* stumps only 5 per cent. produced shoots, and all of them subsequently died.

23.24.2. *Methods of Planting*

23.24.2 : 07.7. MESSER, H. Der Forstkulturspaten, Saurus. **['Saurus'—a spade for forest planting.]** *Forstarchiv* 20, 1944 (54–8). [G.] [1756].

The spade weighs 4·2 kg. but is easy to handle. It has two blades; (*a*) normally situated but curved in transverse section to form a concave back; (*b*) a plane median cutting blade, welded at right angles to the forward surface of (*a*). The handle has a strong forward sweep. The tool was designed primarily for planting large stock of shallow rooters such as Spruce, and is used as follows: (i) insert vertically, 10–15 cm. deep; (ii) pull back the handle till the point of the blade is at the appropriate planting depth; (iii) push horizontally forward (this needs strength on heavy soils) for 30–40 cm., which will leave a small 'saddle' formed by the concave back of the main blade; (iv) repeat the process with blade inserted to full depth; (v) lift handle until the main blade is at about 60° to the soil surface; behind the main blade there are now a hole scooped by the point of the blade and a convex saddle, on which a second person spreads the roots, holding the stem dead behind the secondary blade and guiding it into the slit formed by the latter when (vi) the spade is pulled out backwards and upwards with a light shake to distribute loose earth on the roots. It only remains for the second person to see that the plant is erect and to firm the soil. The effect is thus to secure a kind of horizontal notching. For very large stock the process should be repeated 20–30 cm. away, which gives 4 flaps to be rolled back and firmed after planting. On light soils, stage (iv) should not be needed. Species with tap roots can be planted in the scooped hole instead of on the saddle. The advantages are provision of a shaped bed on which shallow root systems can be distributed without distortion and with no alteration of position as the spade is withdrawn, and alternatively, for deep rooters, of a simplified method of pit planting. From a time study it appears that a team of two (of whom one can be a woman or youth) can plant per hour 50 2-year-old Larch 40–60 cm. high, which is quicker than normal for pit planting: with Spruce the saving of time should be still greater. An adequate time comparison, however, is not yet possible. Disadvantages are that the soil must be free of coarse stones to 30 cm. depth, that if grass competition is important, the grass is not pared off, and that it may not be possible to secure full occupation for both members of the planting team. Preliminary results from varied sites have been very good.

23.24.2 : 12.25. BRITISH HONDURAS. **Report of the Forest Department for the year ended 31st December, 1944.** Govt. Printer. 1945. pp. [13]. [1757].

Transplanting trials in British Honduras showed that *Pinus caribaea* is very intolerant of root disturbance during planting, final mortality being as much as 80 per cent. Finally, good results were obtained by lifting each plant with a ball of earth and firming it into the planting site after cultivating the ground surface with a spade. This method gave 95-per-cent. survival with virtually no setback. Growth recommenced in 10 to 14 days. Moreover the plants showed themselves tolerant of high temperatures and relative extremes of wet and dry weather, and, as a result of this, the planting season may now be extended over 8 to 9 months of the year (p. 6).

23.24.3. *Spacing*

23.24.3 : 12.25 (41.1–4) : 24.2. HOME, J. M. **Notes on growth of Sitka Spruce.** *Scot. For. J.* 59, 1945 (84–6). [1758].

Comparative data are given for two plantations of Sitka Spruce in Argyll and Dumfriesshire. The first is 21 years old, was planted with a spacing of 6 ft. and heavily thinned; the second is 32 years old, was planted with 4-ft. spacing and has been more lightly thinned. In the 6 × 6 ft. planting, at 21 years, the original 1,200 plants have been reduced to 360. In the 4 × 4 ft. planting, at 32 years, the 2,700 plants have been reduced to 528. The average volume per tree is over 10 cu. ft. in the younger crop as against rather less than 9 cu. ft. in the older crop (both measurements over bark). The total volume of thinnings is almost equal, but is slightly larger in the case of the younger crop and wider planting interval. The results seem to indicate that in view of the existing level of wages and the high cost of plants, a planting distance of 6 ft. at moderate elevations is fully justified.

The comparatively heavy thinnings in the younger stand were undertaken in order to determine whether it was possible to reduce the number of thinning operations necessary without affecting the increment or the quality of the crop. A fairly heavy thinning at intervals of roughly 5 years, producing a heavier yield, is a considerable economy where a large area is under forest in age classes up to 50 years. The experiment may be considered successful, in that at 22 years the volume of the stand is excellent. It is also apparent that over-thinning rarely occurs, and the loss of increment from insufficient thinning is perhaps much greater than is generally realized. Once thinning starts, it appears that about one-half of the current annual increment can be profitably removed, and that, if practicable, a thinning every third year should be made in existing stands where it is impracticable to adopt a heavier thinning at longer intervals. The heavier 5-yearly thinnings can only be practised in stands which have been treated in this way from the beginning.

23.24.3 : 12.25 : 31.8 (931) : 23.1. New Zealand. **State Forest Service: annual report of the Director of Forestry for the year ended 31st March, 1945.** Govt. Printer, Wellington. 1945. pp. 35. [1759].

The results both of assessment surveys and of trials in the sawing, drying and utilization of young *Pinus radiata* timber for house building have clearly demonstrated the bad effects of 8 × 8 ft. planting on stands of this species in the pumice lands of the Bay of Plenty and Taupo districts and the wisdom of the Department in reverting to closer spacing. In order to produce timber free of defects and with a significant proportion of heartwood, Radiata Pine should be managed on at least a 40-year rotation and some stands on as much as a 70-year rotation. Continued observations upon clear-felled areas of *P. radiata* show that natural regeneration cannot always be relied on even in the most favourable sites in New Zealand (p. 2).

23.24.3 : 12.26–8 : 76.1 : 21 (54.87). Ceylon. **Silvicultural Research Administration, 1943.** Typescript. 1945. pp. 14. [1760].

Important silvicultural advances have been made in the initiation and management of plantations of *Casuarina equisetifolia.* Initial spacing of plants has been gradually increased from 6 × 6 ft. to 12 × 12 ft. without increasing the period within which full cover of the plantation floor is established to more than 2 years. Watering of plants is decreased from every day of the dry weather of the year following that of planting to only twice a week or at one-day intervals for a period of 6–7 months. The increase of spacing, whilst making for better growth and larger crowns, as befits trees grown for fuel, has also made it possible to plant 3 times the area with the same amount of field labour. The financial result is that costs of formation have been reduced roughly from about Rs. 300–350 to Rs. 50–60 per acre at pre-war rating.

Further attempts at reduction of costs by planting in cleared land without burning and in 10-ft.-wide lines cleared at 20- to 25-ft. intervals in the scrub jungle have proved to be more expensive and more difficult to manage than planting after wholesale cleaning and burning (pp. 6–7).

23.26. Plant Rearing. Nursery Practice

23.26. Aun, H. Pflanzenerziehungsversuche nach einem patentierten Verfahren. **[Experiments in raising plants by a patented process.]** *Forstarchiv* 20, 1944 (59–60). [G.] [1761].

The process patented (German No. 678,593) by A. Dunemann consists essentially in using a seedbed made of needle litter several decimetres deep, with a thin covering of soil, e.g. into a frame about 40 cm. high is tipped Spruce or Weymouth Pine litter, without any further admixture, which is trodden down in a moist condition and covered with about $\frac{1}{2}$ cm. of fine earth, preferably pure humus soil, pressed down with a board, sown and covered again with fine earth or sand. The bed is then watered with water warmed by standing in the sun. Excessive insolation is prevented by covering lightly with branches, which are removed at night when watering is done. From August onwards watering and covering with branches is discontinued. In November and December the plants should be double the size of those raised by ordinary methods. Weed growth and soil crusting are largely prevented. In the following year the plants may be transplanted or allowed to grow on in the bed. Two-year-old seedlings are sufficiently developed for planting out.

In comparative trials at Elberswalde with Pine, results with this method were superior, in spite of sowing 3 weeks later, to those on a normally manured seedbed, growth by the first autumn (normal seedbed in parenthesis) being: mean plant length 23 (16) cm., shoot length 8 (6) cm., root length 15 (10) cm. The plants raised by Dunemann's method had a better developed root system, larger and thicker needles, stems at least twice as thick as controls, and formed whorls; mycorrhiza formation was equally good or possibly somewhat better in the controls.

Elsewhere, trials with Aspen, Birch, Field and Norway Maples, Common and Grey Alders, Spruce, and Pine, all showed better growth, particularly of the root system, with the Dunemann method, again in spite of later sowing than in controls. The question of costs remains to be investigated.

23.26. Nordin, E. Om plantskolors planläggning och skötsel. **[The planting and care of nurseries.]** *Skogen* 32, 1945 (349–51, 366–8). [Sw.] [1762].

A condensed account, on conventional lines, of nursery practice, including sections on siting, preparatory cultivation, lay-out of beds, seed disinfection, sowing, care of individual species, transplanting, weeding, manuring, spraying, frost heaving, and the distribution of produce. It is stressed that (i) dense sowings make for good stock with good resistance to frost heaving, but (ii) dense sowings of conifers necessitate thinnings in the seedbed, e.g. 20- to 30-per cent. thinnings in one-year-old Pine and Spruce and in two-year-old Spruce that is to stand over for 3/0 stock; (iii) weeding is of vital importance and must begin as early as possible in spring; (iv) manuring is best done with compost containing P and K fertilizers; (v) accurate booking of the stock is essential to keep track of provenances.

23.26 : 11.47.1 : 12.11.3 : 07.7. Pablo. Några glimtar från en plantskola. **[Notes on a forest nursery.]** *Skogen* 33, 1945 (9–11). [Sw.] [1763].

Good results have been obtained at a nursery in the Stockholm district by natural manuring and fertilizer applications, at rates normal for agricultural crops, every fourth year, when a crop of potatoes is taken. To aid in weed control, the latter are earthed up 3–4 times. Two crops of tree seedlings are then taken, rotating conifers and hardwoods when possible, with no manuring. Cones received are classified into those from élite parent trees and those collected on felling sites; the plants raised are classified in 6 categories by quality, and those from élite trees and of first quality are intended to be used for permanent seed plantations. Special tools used include an outsize planting bar, 8 cm. square, for planting out the large stock obtained (e.g. 1-year Oak and Beech up to 75 cm. high), and a 'sowing sledge' of simple wooden construction which levels the seedbed and draws drills of accurate depth.

23.26 : 23.23. **The rearing of forest trees.** *Scot. For. J.* 59, 1945 (39–55). [1764].

This article is intended as a guide to landowners who wish to run a small estate nursery and who are not acquainted with the operations involved in raising forest trees from seed. A description of the process is given from seed collection to transplanting. Particulars are given of seed extraction, preparation of seedbed, preparation of seed, density of sowing, method of sowing, weeding and transplanting. Scots Pine (*Pinus sylvestris*) is taken as an example under the headings seed and sowing.

23.26 : 12.26–8 : 34.25. Pennock, W. **Notes on Cinchona cultivation.** In *Plants and Plant Science in Latin America.* Chronica Botanica Company, Waltham, Mass., 1945. pp. 202–5. O.B.D. [1765].

Practical information is given on the selection of the nursery site, the type of seedbed, the sowing and tending of seed (with special reference to watering and shade control), transfer of seedlings from seedbed to nursery, permanent field plantings, disease control measures and grafting.

23.26 (69) : 45.3. Mauritius. **Annual report of the Forest Department, 1944.** Govt. Printer, Port Louis. 1945. pp. 12. [1766].

Prodenia cutworms caused considerable loss in Pine seedbeds. Poison baiting had little effect, but an improvement occurred when heavy rains ceased. All Pine seedbeds are now fitted with removable wooden covers during germination, and complete control of soil moisture should be obtained by this means; the larva clearly does not thrive in moderately dry soil (p. 5).

23.27. Arboriculture

23.27 (410) : 21.0 : 23.26. Ross, D. **The management of young trees with a view to rendering them suitable for planting in avenues, streets, and public parks, with suggestions as to suitable species.** *Scot. For. J.* 59, 1945 (70–8). [1767].

After some general remarks on the type of tree desired for planting in avenues, streets and public parks, the writer gives detailed notes on nursery management and selection of species, and on the special treatment of parks, and ends with a table of the more hardy trees recommended for planting in and around towns. *Author's summary.*

23.27 (68.9) : 23.2. Dutton, E. A. T. **The planting of trees and shrubs, with special reference to Northern Rhodesia.** Govt. Printer, Lusaka. 1937. pp. viii + 144 + xix. [1768].

This book has sections on soil, propagation, gardens, hedges and border plants, street planting, windbreaks, insecticides and fungicides. More than half the book is devoted to a descriptive list of trees and shrubs already established and now under trial at Lusaka.

23.3. *Afforestation*

23.3 (41.1–4) : 12.19 : 21.0. Geddes, A. **Ecology, landscape and the forester.** *Scot. For. J.* 59, 1945 (79–83). [1769].

Reviewing a group of papers in a previous volume [see *For. Abstr.* 6 (200, 201, 268)], the writer reaffirms the thesis that, to be successful, afforestation must be based on ecology. As an indication of practical method, a table is given showing the types of plant community which may guide the forester in the choice of species for a West Highland moorland. *From author's summary.*

23.3 (44). Guinier, P. La mise en valeur des Landes de Gascogne et la création de la forêt landaise. L'oeuvre de Chambrelent. [**The improvement and afforestation of the Landes of Gascony. The work of Chambrelent.**] *Rev. Eaux For.* 83, 1945 (445–69 + plates). [F.]. Sargoz, R. Contribution à l'histoire du boisement des Landes. [**Contribution to the history of the afforestation of the Landes.**] *Rev. Eaux For.* 83, 1945 (521–34). [F.] [1770].

Two historical accounts of the draining, improvement and afforestation of the Landes of Gascony. [Cf. *For. Abstr.* 7 (No. 1583).]

23.3 (489) : 22.83 : 21.64 : 11.48.2. Bornebusch, C. H. Revision af Haarup-Sande-Forsøget. [**Revision of the Haarup-Sande experiment.**] *Forstl. Forsøgsv. Danm.* 16, 1943 (257–64). [Dan.f.] [1771].

The Haarup-Sande experimental plots were laid out in 1923 by Prof. F. Weis on wind-eroded sands, with exposed hardpan, in the Gudenaa valley near Silkeborg. After cultivation for two years under lupin, *Ornithopus*, *Spergula* and *Triticum aestivum*, accompanied by the application of different fertilizers and lime, the plots were planted with (*a*) Japanese Larch with Grey Alder and Scots Pine, blanks being filled with Engelmann Spruce and Noble Fir; (*b*) Sitka Spruce with Grey Alder and Birch (*Betula pubescens*), blanks filled as for (*a*); (*c*) Scots Pine with *Hippophaë* and Sitka Spruce, blanks filled with Scots Pine and *Pinus contorta*; and (*d*) Japanese Larch with *Hippophaë* and *Sorbus scandica*, blanks filled as for (*a*). Dead Birch and *Sorbus scandica* were replaced with *Quercus borealis*; Grey Alder and *Hippophaë* with *Caragana*.

In 1933 the plantations were reported to have done extremely well. Later, however, a decline set in, and at the revisions in 1938 and 1941 Scots Pine was the only conifer showing satisfactory growth. This species had formed some closed stands and was regenerating naturally on blanks in the other plots. The remaining conifers varied from poor to complete failures. Of the broadleaved species and shrubs few remained and none could be regarded as successful.

The herbaceous vegetation that at first appeared had almost completely made way for a vegetation of lichens, impoverished heather, with *Cladina* and *Polytrichum piligerum* growing in the open spaces between the heather. The flora appears to be reverting to the natural state for the site, which is heathland of the *Cladina/Calluna* type with mediocre Scots Pine.

23.3 (489) : 23.51 : 12.25 : 21.0. Løfting, E. C. L. Hedeskovenes Foryngelse. VII. Et Underplantningsforsøg i Gludsted Plantage. [**The regeneration of the heathland forests. VII. An underplanting experiment in Gludsted Plantation.**] *Forstl. Forsøgsv. Danm.* 16, 1945 (305–22). [Dan.f.] [1772].

Plantations of Mountain Pine of French provenance formed in 1901–02 and suffering from attack by *Lophodermium*, were underplanted in spring 1927 with a variety of species, the plantings being made in pits prepared in the preceding autumn. The progress of the young stands is reviewed and illustrated. In spring 1943, results were as follows: (i) Norway and Sitka Spruce showed even and comparatively constant height growth and had reached mean heights of 2·57 and 2·90 m. respectively. In the early stages they had sustained light attacks by *Strophosomus* and later were somewhat suppressed by the overwood; both species, however, appeared vigorous in 1943. Island Sitka was inferior to other provenances and suffered extensively from frost. (ii) Beech, sown with planted Birch and also planted with *Abies nordmanniana*, showed very good height growth initially. In spring 1943 the stands appeared healthy and had reached heights of 2·30 and 2·20 m. respectively. (iii) Silver Fir and *Abies nordmanniana* made roughly equal height growth (1·90 and 1·80 m. respectively). The former, but not the latter, suffered much damage from spring frosts in spite of the presence of overwood. Both had been attacked in places by *Chermes piceae* and *Mindarus abietinus*. (iv) European Larch and Grey Douglas Fir both grew well at first but later suffered respectively from Larch canker and *Rhabdocline pseudotsugae*. (v) Japanese Larch and Green Douglas Fir showed excellent height growth, averaging respectively 47 and 42 cm. per annum, their height in 1943 being 6·30 and 5·50 m. The Douglas, however, has undergone numerous attacks from *Phomopsis pseudotsugae* and its increment is slackening owing to the influence of wind.

The results confirm the value of Mountain Pine as a first soil-improving crop for poor heathlands. [Cf. *For. Abstr.* 7 (No. 1779).]

23.3 (489) : 12.25 : 22.83 : 21.0 : 23.52. Løfting, E. C. L. Hedeskovenes Foryngelse. VIII. Lærkearternes Udvikling i Hedeplantagerne og Japansk Lærks Anvendelighed som Hjælpetræ ved Opbygning af Hedeskov. **[The regeneration of the heathland forests. VIII. The development of Larch species in the heathland plantations and the suitability of Japanese Larch as an auxiliary species in the establishment of heathland forest.]** *Forstl. Forsøgsv. Danm.* 16, 1945 (323–64). [Dan.f.] [1773].

The poor results given by European Larch in Danish heathland plantations seem to be due chiefly to attack by *Dasyscypha willkommii*. Various provenances are still under trial.

Of other species tried, Siberian and Korean Larch appear to be failures, Kurile and Dahurian Larch have succeeded only in isolated cases under favourable conditions, but Japanese Larch has shown good resistance to *Dasyscypha*, excellent height growth, and an ability to succeed with little soil cultivation or cleaning.

Only a few of the Japanese Larch plantings are over 20 years of age. A plantation at Gludsted, made in 1915, had some trees as high as 13–14 m. in 1943. The younger plantations are very promising in most localities, but on extremely poor and dry soils the species does not do well and is sensitive to late summer drought. It is therefore not recommended for planting on dry wind-eroded sands, dry southern slopes, or where precipitation is particularly scanty. Observations have shown that an admixture of Japanese Larch improves the growth of Norway Spruce, and an experiment in Grindsted Plantation, designed to test the effect of liming, also showed that the height growth of both Norway and Sitka Spruce was improved by such an admixture. In connexion with the probable use of the species for mixed heathland plantings it is stated that: (i) Though seed now has to be imported, it should soon be possible to cover requirements from home-grown seed, and as 1/1 stock is suitable, plant supplies could be produced cheaply. (ii) With the above-mentioned exception of dry sites, Japanese Larch could be used as the sole auxiliary species in a mixture, or Mountain Pine could be added in doubtful cases. (iii) Soil cultivation and cleanings suited to Spruce would be more than adequate for Japanese Larch. (iv) The species is not particularly subject to attack by *Fomes annosus* and should thus improve the health of plantations. (v) Japanese Larch should not constitute more than 25 per cent. by number of the stand: a favourable mixture should be Norway Spruce with Larch and Silver Fir. Pure plantations of Japanese Larch are not recommended. (vi) Apart from its high resistance to *Dasyscypha*, it is believed that attacks by insects such as *Nematus ericsonii* and *Coleophora laricinella* would not be extensive.

Hybrids between Japanese and European

and Kurile Larch respectively also deserve trial under Danish conditions.

23.3 (494). WINKLER, O. Die Aufforstungen im mittleren Taminatal. [**Afforestation in the middle Tamina valley.**] *Schweiz. Z. Forstw.* 96, 1945 (83–91 + plate). [G.] [1774].

A short historical account of public afforestation against avalanches. Data are given on the execution of the work and its cost. In all 44·8 ha. were afforested between 1894 and 1912 at a cost of 139,090 Fr. Though fulfilling their function of preventing avalanches, the stands are in an unsatisfactory condition, partly owing to the use of unsuitable provenances.

23.3 (494) : 23.5 : 38.8. BY, J.-L. Les travaux de reboisement et de défense exécutés en Suisse de 1876 à 1943. [**Afforestation and protection works carried out in Switzerland from 1876 to 1943.**] *J. for. suisse* 96, 1945 (101–15). [F.] [1775].

The article first gives a brief account of Swiss federal legislation on the subject of afforestation and protective works. The total sum expended for this purpose from 1876 to the end of 1943 was about 51·9 million francs, of which 59 per cent. was provided by the Federal Government, 19 per cent. by the Cantonal governments, and 22 per cent. by private owners. During the period under review 156 million trees were established, in plantations, 72 per cent. coniferous and 28 per cent. broadleaved species. The proportion of broadleaved species has risen in recent years, and at the present time amounts to about 44 per cent. Since 1876, a total of 25,517 ha. has been afforested; of this, 23,821 ha. are new plantations, and 1,696 ha. reforestation of devastated forests.

An account is given of drainage works, protection against avalanches, landslides, etc., correction of torrents, fencing of pastures, building of roads.

Experience has led to the abandonment, in great part, of the earlier policy of establishing pure stands of exotic or (later) indigenous conifers. The system now employed in the afforestation of degraded forest or submarginal land is to aim first at a transitional type composed of such species as Sycamore, Birch, Alder, Aspen, Service tree, Whitebeam, Hazel, Willow, to be followed by *Pinus montana* and sometimes Larch. The valuable species (Spruce, Larch, *Pinus cembra*, *Pinus sylvestris*, Fir, Beech) are introduced only when the auxiliary species have sufficiently restored the soil and provided the shelter necessary for their satisfactory growth. In some situations, closure to grazing is sufficient to ensure this.

The final part of the article gives some account of the construction of protective works.

23.3 (54.5) : 11.47 : 11.62 : 24.4. GORRIE, R. M. **Desert fringe afforestation: areas with a rainfall of below 30 inches.** *Indian For.* 72, 1946 (12–5). [Soil Conservation Circle, Punjab, Lahore.] [1776].

During the last 75 years, since first the Punjab was confronted with a fuel famine for the then wood-burning railway engines, and the Chhanga Manga irrigated plantation was established to meet this shortage, the forest department has built up a body of experience in desert-fringe reclamation. This paper outlines these methods under the headings of terracing, water-spreading, working the surface soil, sub-soiling. Having established the best possible system of water catching, it remains to make the best use of the ground by introducing the most suitable permanent dry farming, afforestation and shelterbelt practice. Grazing must be under very strict control. Afforestation need not be with timber trees and much of the desert fringe will not produce them. Much can be done with the giant cane grasses (*Saccharum munja* and *S. spontaneum*). The ideal form of windbreak to counteract the force of the desiccating summer west wind is probably an outer and lower fringe of agaves, then cane grass and shrubs, leading up to high trees in the rear.

23.3 (54.87) : 23.22. HOLMES, C. H. **Grasslands and their afforestation in Ceylon.** *Indian For.* 72, 1946 (6–11). [1777].

The very extensive grasslands of Ceylon must be regarded as ecological pre-climaxes arrested and maintained in this stage of seral succession by periodic burning and grazing. The afforestation of these areas, particularly those of the highlands, is highly desirable for the purpose of soil and water conservation and, incidentally, to provide fuel and timber for the locality. Some account is given of the attempts at afforestation already made. Trials with afforestation of the wet low-country *talawa* grasslands were in the main unsuccessful, owing to the impoverished soil. The species which did best were Caju (*Anacardium occidentale*) and *Alstonia macrophylla*. With the object of arresting further erosion, conserving moisture, and collecting the little surface soil there is for the plants introduced, a further set of trials has recently been laid out, using the species most successful in previous trials, planted in contourwise trenches. The first year's results already show a definite improvement on any previously gained.

More concentrated and comprehensive work has been done on the up-country *patanas*, particularly of the dry type. Of the conifers experimentally planted, only the Sand and particularly Rock Cypresses (*Callitris glauca*, *C. calcarata*) have thriven under *patana* conditions. As a class, the Eucalypts have done best, particularly *Eucalyptus robusta*, *E. citriodora*, *E. microcorys*, *E. maculata*, *E. saligna*, *E. regnans* and *E. pilularis*. The best all-round species is Red Gum (*E. robusta*). All the timber Eucalypts (*E. citriodora*, *E. maculata*, and *E. microcorys*) do better in the dry *patanas* than in the wet black *patanas*, but in the former they tend to be suppressed in close mixtures with Red Gum, and do better in plantations composed of 50–75 per cent. of *Callitris calcarata*, which is the best species yet discovered for poor soils on the tops of ridges, hills and knolls. It is concluded that it would be preferable to carry out future afforestation in group mixtures, selecting sites to suit the individual species, rather than in single-stem and line mixtures as hitherto. The initial cleaning and burning of the *patana* grasses and arrangement of the clods and refuse in contourwise ridges to reduce erosion is a necessary preliminary to planting. Patch planting with removal of grass in a radius of 1½ ft. round each plant, extends the period of establishment from 1 to 5 years and seriously impairs the health and vigour of plants of all species. Large-scale trials have established that clean weeding thrice in the first year followed by strip or patch weeding in the second is generally sufficient, provided that the initial clearing and burning has been satisfactorily executed. This reduces weeding costs from about Rs. 40 to Rs. 14 per acre or less at pre-war rates.

Another expensive item of work is the deep holing presumed to be necessary on account of a compacted layer of quartz and ferruginous gravel at about 18 to 24 in. below the surface of the soil. Experiments are in progress to determine how far this layer really interferes with tree growth. The earliest trials are now about 4 years old and there is as yet no apparent difference between holing depths varying from 6 to 24 in. It is likely that in the mid and lower slopes a considerable reduction in holing depth, and therefore in formation costs, could be effected.

Besides other benefits accruing from the afforestation, it conserves and improves the soil to a moister and more fertile condition than is possible under perennial grass. This is shown by the natural colonization by indigenous mesophytic types which is taking place in the plantations on dry *patana* grasslands. In one such area the overwood, now 20 years old, is being gradually removed, leaving a natural forest with about 9,000 plants to the acre, and an average height of 10 ft. for the dominant and most frequent species (*Litsea* spp.).

23.5. Underplanting. Shelterwoods. Nurses

23.5 (69). MAURITIUS. **Annual report of the Forest Department, 1944.** Govt. Printer, Port Louis. 1945. pp. 12. [1778].

Certain Pine plantations in Mauritius have an underwood of Tea bushes, in one case 30 years old under 15-year-old Pine. Some of the Tea is still bearing and regularly plucked and pruned, and its obviously healthy condition has suggested that the combination might be extended. Rainfall is greatly in excess of the requirements of both Tea and Pine. The mixture is to be the subject of scientific study, and a sample plot has been laid out, in which the plucking and weighing of leaf will be supervised by a Forest Officer (p. 3).

23.52 (494) : 12.25 : 42.21 : 11.11.2. NÄGELI, W. De l'emploi du Pin de montagne comme essence d'abri dans les bas-fonds du Jura. **[The use of *Pinus montana* as a shelter species in frost pockets in the Jura.]** *J. for. suisse* 96, 1945 (35–41). [F.] [Institut fédéral de recherches forestières.] [1779].

In 1923 and 1924 the Federal Institute of Forest Research established two experimental plantations of *Pinus montana* in what are probably the most extensive frost pockets in the region of Marchairuz in the Jura. This article describes the first phase of development, and the following table gives results for the first 20 years of the experiment.

Site	*Inventory*		*Number of plants*			*Height in cm.*		
	Year	*Age*	*Originally*	*Surviving*	*Per cent. reduction*	*Minimum*	*Maximum*	*Average*
Grande Chaumille established 1923	1935	18–19	1,790	1,293	28	11	205	81
	1944	27–28	1,790	1,127	37	50	390	174
Sèche des Amburnex established 1924.	1935	17–18	413	196	53	25	192	91
	1944	26–27	413	166	60	40	390	175

It is believed that a considerable proportion of the losses is due rather to the extreme dryness of the sites than to frost. The average height of the Pines (174–175 cm.) already exceeds that of the surrounding stunted Spruce (at least 100 years old), and the average rate of growth is increasing. Where Pine and Spruce grow side by side at close quarters it may be clearly observed that the latter are already benefiting by some protection against frost. They are less misshapen than those which do not enjoy this shelter and in particularly favourable cases have developed a single, normal crown. It is hoped, therefore, that the plantations will result not simply in the formation of a stand of Mountain Pine but will permit the establishment of a mixed stand. Where Spruce is abundant it is even probable that the Mountain Pine will be gradually relegated to the understorey; all that is necessary to effect this is that the Spruce should emerge from the layer of cold air which at present keeps it down. Gaps in the plantations should in future be filled with Spruce of local provenance, where the sites are suitable. It is not known whether there actually exists a race of Spruce suited to these special conditions, but in any case it should not be sought in the Alps, since the Alpine Spruce, on account of its growing season, is in a large measure protected against early frosts, but is more exposed than the indigenous Jura race to the action of late frosts. [Cf. *For. Abstr.* 7 (No. 1772).]

24. TENDING OF STANDS AND TREES

24 : 12.26–8 : 12.11.3 : 23.52. SCHÄDELIN, W. Die Auslesedurchforstung als Erziehungsbetrieb höchster Wertleistung. **[Selective thinning as a system of raising stands of maximum value yield.]** Verlag Paul Haupt, Berne and Leipzig. 3rd ed., 1942. pp. 147. [G.] Price 13*s*. 6*d*. [1780].

A third, revised, edition of the treatise first published in 1934 as 'Die Durchforstung als Auslese- und Veredelungsbetrieb höchster Wertleistung', brought up to date from the author's own experience and with due regard to the work of others, e.g. Vanselow, Rohmeder, Gelinsky, and Mayer-Wegelin. The fundamental points of view in this work (expressly restricted to production forest not managed on the selection system but designed to secure optimum timber production with maintenance of optimum site conditions) are (*a*) that the tending of a wood must be treated as a continuous process of selective training from the earliest stage onwards, each measure undertaken paving the way for succeeding measures, and (*b*) to leave nature to complete the tending measures performed, i.e. not to do work that nature will accomplish given a minimum of intervention. Nevertheless, great emphasis is laid on giving the best possible care to woods in the stages before thinning proper begins, as only the encouragement of the better and suppression or elimination of the worse material in these stages can provide the material from which thinnings will ultimately eliminate all but the best.

To secure continuity of exposition the discussion is built mainly around a particular example—that of midland Swiss Beech of site qualities 1 and 2, assuming dense, sound, uniform, natural regeneration of provenance suited to the site—and an attempt is made to develop the ideal picture of such progressive, selective treatment from early youth onwards, though other species and conditions are dealt with incidentally. Successive chapters are devoted to the care of young growth before closure; cleanings; thinnings (including sections on selective thinnings, thinnings for light increment, and the auxiliary stand and its functions); and selective thinning of uncleaned woods.

The final chapter deals with incidental measures designed to improve quality, viz. the protection of élite stems against excessive insolation, early rough-bark formation, epicormics, etc., by the auxiliary stand, and natural and artificial pruning. There is a bibliography of 43 references. [Cf. *For. Abstr.* 7 (Nos. 1715, 1750, 1784).]

24 : 12.26–8 (485) : 97.3 : 44.3. BERG, N. R. Lövträden i dagens skogsbruk. **[Hardwoods in forestry today.** (With discussion).] *Svenska SkogsvFören. Tidskr.* 44, 1946 (1–28). [Sw.] [1781].

A general introductory review, delivered at a meeting of the Swedish Forestry Association, with emphasis on the need for maintaining hardwoods in Southern Sweden and the concentration on production of quality timber necessary to this end [cf. *For. Abstr.* 7 (Nos. 1165, 1722)]. Closure to grazing and judicious choice of species and site, together with proper tending, are the essentials for success. For Oak it is recommended to begin cleanings at 15 years and then approximately every third year, leaving other species as fillers until the Oak is capable of giving full canopy; where artificial regeneration is necessary, special attention should be given to provenance. For Birch in predominantly broadleaved stands, residual, inferior and wolf trees should be removed at 10 years and tending operations should continue at intervals of 3–4 years; at about 35 years, when the boles should contain the equivalent of two clear logs by height, heavier thinnings should begin, giving crowns almost free at 40 and quite so at 50 years. The frequent natural understorey of Spruce is often advantageous: it can be cut as pulpwood if interfering with the Birch crowns, and the mixture allows of varied treatment according to circumstances. In true mixed forest, group mixtures are probably best, owing to the danger of Birch causing damage to its neighbours by whipping. Alder is best on good fen sites and prefers moving groundwater: caution is necessary in thinning, to avoid the formation of water sprouts. Aspen has suffered much in the past from grazing damage. In vigorous stands, properly handled, increment may exceed rot development and so yield merchantable material for the match industry [cf. *For. Abstr.* 7 (Nos. 1854, 2108)]. Ash is best on heavy, moist soils, preferably with good drainage: it is frost-sensitive and would generally require a shelterwood. For all species the aim must be clean timber, preferably achieved by natural pruning in dense young stands. Epicormics in Oak, Beech and Alder may have to be removed by pruning, in which case this should be done while the epicormics are still young and in late summer. The results of pruning young hardwoods in general, however, are doubtful and great caution is recommended. In discussion, contributors stressed the necessity of quality production and several had serious doubts of the advisability of pruning, particularly live pruning [cf. *For. Abstr.* 7 (No. 1790)], and believed that natural pruning in dense young stands was much the best method. H. Sjöström reported rot damage in all of a trial series of Birch live-pruned, at the end of winter, flush with the stem, though he believed that live pruning of branches between pencil thickness and 3 cm. might be safe if a stub 3–5 cm. long were left and removed 3 years later. G. Lundberg said that sap flow ('bleeding') encouraged fungus attack, and advised pruning a few days after foliation when the sap pressure should be low. E. Rennerfelt mentioned that unpublished work by the State Forestry Research Institute so far showed that irrespective of season and method, pruning of Aspen was followed by rot, and Birch also showed serious rot. W. Ros urged the desirability of means of disposing of intermediate yields, and of subsidies for hardwood cultivation. G. Ullen had evidence suggesting that Spruce grown for more than one rotation on a hardwood site caused deterioration in site quality. F. Stålfelt, dealing with Aspen, stressed that to leave inferior trees when making regeneration fellings was to invite development of poor strains as clones by root suckering. Young Aspen should be kept dense in the thicket stage, but after the first thinning, subsequent thinnings should be frequent and of increasing severity until the final felling at 50–60 years. For this species, moving groundwater is more important than a soil rich in nutrients. The new grading rules should enable the sale of a great deal of Aspen timber for match manufacture and render Aspen more attractive as a crop. N. B. Hansson dealt with the serious damage caused by grazing, and was in favour of special legal restrictions on grazing and other practices harmful to hardwoods in S. Sweden.

24.2. *Thinnings*

24.2. CEYLON. **Silvicultural Research Administration, 1943.** Typescript. 1945. pp. 14. [1782].

In the better-quality sample plots, the more satisfactory response to heavier thinnings ('C' grade removing 35 per cent. of the stand as opposed to 'B' grade removing 25 per cent.) has been maintained. In the less heavily thinned plots the Mahogany has tended to fill up and close cover under the Jak (*Artocarpus integrifolius*), whereas in the more heavily thinned plots its response to thinning has been less. The cover over the ground in the former case is principally Mahogany, and in the latter case Jak. The 'A' grade plots are obviously underthinned; although growth and condition have not yet been appreciably impaired, the relation of crown to stem length is about one-eighth (p. 4).

24.2 (410) : 12.25–8. **The thinning of plantations.** *For. Operat. Ser. For. Comm.*, Lond. No. 1, 1945. pp. 40. [1783].

This is the first of a series of pamphlets planned to cover different silvicultural operations; it deals with improvement thinnings and is based for the most part on Forestry Commission experience. The most important step in thinning is to get rid of wolf trees at the earliest possible opportunity; the species in which they are most liable to occur are Scots Pine, Japanese Larch and Douglas Fir. Forestry Commission practice is to thin European Larch and Douglas Fir somewhat heavily at the outset, Scots and Corsican Pine and Sitka Spruce more lightly, and Norway Spruce and shade-bearing species such as *Thuja* and *Tsuga* more lightly still. It is important to repeat thinnings frequently in the stage of rapid growth, and a rough working rule is that repetition is necessary after trees have grown at most an additional 10 ft. The first part of the pamphlet deals with general considerations, e.g. preparatory measures, classification of trees, procedure, frequency, grades of thinning, choice of grade, stocking densities, post-thinning operations. Part 2 deals with treatment of individual species: Scots and Corsican Pine; European, Japanese and Hybrid Larch; Douglas Fir; Norway and Sitka Spruce; Oak; Beech; Ash; Sycamore; Sweet Chestnut; Birch; Poplar; with less detailed notes on other conifers and hardwoods. Part 3 deals with thinning of mixtures. For the more important species tables are given of number of stems in relation to top height in normal plantations.

24.25 : 12.26–8 : 56.2 : 66 : 12.19.23. BORNEBUSCH, C. H. Udhugning og Produktion i Bøgeskov. Forsøg i Aarhus Kommunes Skove. **[Thinning and increment production in Beech forest. An experiment in the forests of the commune of Aarhus.]** *Forstl. Forsøgsv. Danm.* 16, 1944 (273–304). [Dan.f.] [1784].

Thorskov and Skaade, the woods in which this experiment was made, consist of practically pure Beech, on soils varying from stiff clay to sand. The areas had always been very lightly thinned except for one heavy thinning in 1918, after which they remained untouched until 1925. From the latter year, when the stands were 95–105 years of age, until autumn 1942, a series of 22 plots was subjected to frequent heavy thinnings, while a control series of 9 plots was left undisturbed.

The ground flora, which was initially very poor, was improved by the thinnings but was still poorer than that of first-class Danish Beech stands on marly moraine soils. It was not possible to obtain satisfactory advance growth as a result of the thinnings. Representative growth data are summarized in the accompanying table:—

	Thinned plots		*Unthinned plots*	
	1925	1942	1925	1942
Stems, per ha.	356	163	333	333
Height, m.	24·5	27·9	24·3	28·3
Diameter, cm.	33·6	43·5	34·4	38·5
Sectional area, sq. m. per ha.	30·1	23·9	30·1	38·0
Form factor	0·643	0·630	0·644	0·607
Volume, cu.m. per ha.	475·0	421·7	472·5	653·7

The current annual increment (cu.m. per ha.) and increment per cent. (quoted in parenthesis) for the individual periods between thinnings were 12·0 (3·3), 11·4 (2·6), 9·1 (2·2), 12·6 (3·3) and 10·0 (2·4) for the thinned, and 12·9 (2·6), 11·5 (2·1), 8·6 (1·5), 10·5 (1·7) and 9·5 (1·5) for the unthinned plots. Total yields for the 17-year period were 188 and 181·2 cu.m. per ha., and mean annual increments 11·1 and 10·7 cu.m. per ha. for thinned and unthinned plots respectively. The results show that, given a rotation of 120 years or more, there is little difference in total yield between thinned and unthinned stands. As thinnings, even at the relatively advanced age of 100 years and more, can improve the quality of the residual stand and benefit owners by shortening the production period for valuable dimensions, they are amply justified in private forestry. From the point of view of national economy, however, it may be necessary to build up reserves of timber in public forests, and in this connexion it is noteworthy that the experiment demonstrated the possibility of accumulating 24 years' increment (1918–42) in unthinned stands without appreciable detriment to their total increment production. [Cf. *For. Abstr.* 7 (Nos. 1780, 1787).]

24.3. *Opening of the Canopy. Release and Improvement Fellings (including Poisoning and Girdling)*

24.3. CEYLON. **Silvicultural Research Administration, 1943.** Typescript. 1945. pp. 14. [1785].

Poison frill girdling has proved much more effective than plain deep girdling in natural regeneration of dry mixed evergreen high forest; in one experiment 80 per cent. of poisoned trees died in 18 months in contrast to only 15 per cent. of plain-deep-girdled trees. The following mortality statistics from two experiments relate to species particularly difficult to kill. (p. 10).

Species	*Poison-frill-girdled*	*Plain-deep-girdled*
[20 *months after treatment*]		
Wira [*Hemicyclia sepiaria*]	85 per cent.	25 per cent.
Welang [?*Pterospermum acerifolium*]	78 „ „	27 „ „
Then-thukki [?*Dimorphocalyx glabellus*]	83 „ „	47 „ „
[18 *months after treatment*]		
Wira	74 „ „	8 „ „
Welang	37 „ „	6 „ „
Then-thukki	100 „ „	10 „ „
Kuma [?*Gleniea unijuga*]	41 „ „	0 „ „

24.31 : 12.26–8 (73). PARKER, K. W. **Control of Mesquite on southwestern ranges.** *Leafl. U.S. Dep. Agric.* No. 234, 1943. pp. 8. [1786].

The invasion by Mesquite (*Prosopis* spp.) of open range lands in the south-western United States leads to a great reduction in grazing capacity. Taking into consideration the advantages and disadvantages of Mesquite, the problem seems to be one of control rather than eradication; that is, control of further encroachment and the use of practical methods of thinning out the present stands to allow the remaining perennial grasses to spread. Control should not be attempted where the grass cover is so scanty or the soil so subject to blowing, that removal of Mesquite might accentuate wind or water erosion and fail to improve forage cover.

Small seedlings and shrubs of 1-in. diameter or less can be killed by grubbing up the plants to a depth of 5 or 6 in. below the soil surface, and this method is recommended for checking further spread of young stands. In Texas various tools, such as bulldozers, tree dozers, and 'stingers' drawn by caterpillar tractors, have been successfully used for clearing Mesquite-infested land. Tools designed to tear out the main roots near the surface do the work satisfactorily, but those that shear the tree off at the soil surface usually fail to prevent considerable sprouting.

Spraying the trunks of the trees with paraffin from the ground line to a height of 18–24 in., by means of 2- or 3-gallon pressure spray pumps has been a common practice, but the results are very variable. Paraffin has been overrated as a killing agent because it defoliates the upper part of the Mesquite and makes the tree look dead when it is not. Diesel oil is equal, or possibly superior to paraffin as a killing agent, but the average kill seldom exceeds 50 per cent. Best results are obtained when the soil around the stems is soaked with the spray to prevent sprouting, and stems are girdled 12–18 in. above the ground.

Two methods of poisoning with a solution of sodium arsenite have proved effective: root-poisoning by the trench or basin method and stem-poisoning by girdling or frilling. Detailed instructions are given for the mixing and application of the solution and the precautions to be taken in using it. The cost of chemicals varies from 25 to 50 per cent. of the total cost of the operation. One gallon of stock solution (8 lb. white arsenic, 2 lb. caustic soda) will treat about 55 trees. Cost of control may in some instances be met by first harvesting the wood for fuel, fence posts, etc. In Texas, grazing capacity has in many instances been greatly increased by removal of Mesquite and in southern Arizona killing of Mesquite on an area of grassland more than doubled the grazing capacity within 2 years.

24.36 : 12.26–8 : 56 : 63. ZIMMERLE, H. Erfahrungen mit dem v. Seebach'schen Lichtwuchsbetrieb in Württemberg. [**Experiences with the von Seebach system of fellings for light increment in Württemberg.**] *Allg. Forst- u. Jagdztg.* 120, 1944 (29–48). [G.] [1787].

As was expected, Beech stands in Württemberg subjected to thinnings on von Seebach's principles, involving the removal of 40–57 per cent. of the original growing stock at 70–80 years of age, proved inferior in *Derbholz* (timber over 7 cm. top diameter) increment and in only a few cases very slightly superior in basal-area increment. The diameter increment of individual trees, however, was considerably superior in the von Seebach plots and the number of large high-quality timber stems was proportionally greater, i.e. the concentration of (light) increment on the best stems could be expected to compensate, by increased value, for the loss in volume per unit area. Results of supplementary callipering at 5 m. height showed that, with one exception, form and increment at 5 m. on the von Seebach plots left little to be desired. The findings are also held to confirm the author's previous conclusion that Beech rotations aiming at the production of large timber should be raised on site quality I to 140 and on site quality II to 160 years. In conclusion, it is argued that silvicultural difficulties, particularly those connected with regeneration, and the fact that the lower volume production must indicate imperfect utilization of the site, are on the whole against von Seebach's system in its original form. Sudden removal of so large a proportion of the trees is undesirable on biological grounds, and light increment is better obtained by early but more gradual opening of the canopy. [Cf. *For. Abstr.* 7 (No. 1784).]

24.4. *Shelterbelts. Windbreaks*

24.4 (47.0) : 11.62.11 : 12.11.3 : 45.3 : 13.2. SUS, N. I. Zadachi agrolesomeliorativnoy nauki v bor'be s eroziey pochv. [**Tasks of research in agricultural amelioration with the aid of forestry in the fight against soil erosion.**] *Byull. Inst. zern. Khoz. yu.-v. SSSR* No. 1, 1945 (3–15). [Russ.] H.S.B. [1788].

Among agricultural and forestry measures to control erosion, research is proposed on field shelterbelts; sand fixation; improved anti-erosion organization; strip cropping; encouragement and protection of bird life; and forest nurseries, including some for tree breeding.

Stress is laid on shelterbelt plantings. Whereas up to 1940 the chief aim of these was protection against dry winds, wider uses of shelterbelts are now recognized, e.g. regulation of spring run-off, control of water and wind erosion, and improvement in the moisture conditions of soil and subsoil in dry regions. The suitability of tree and shrub species for shelter belt plantings in various phytogeographic zones is to be investigated. Establishment of Willow and re-establishment of Poplar nurseries for selection and hybridization are necessary. Various species of Willow (a genus of many uses besides that of furnishing tanstuffs), Poplar hybrids, and fruit-bearing tree and shrub species, are strongly recommended. Successful crosses have been made of White with 'Canadian' Poplar, Aspen with White Poplar and Siberian with Japanese Larch. Selection of cuttings of a 'red-veined' Poplar (from America) produced plants 8·5 m. high and 19·5 cm. in diameter at 7 years of age.

Great importance is attached to the presence of insectivorous birds in all agricultural and forest plantings, as the annual losses due to insect pests are estimated at an average of one milliard of roubles each for agriculture and forest management. Various schemes are outlined for encouraging insectivorous birds as the natural and cheap means of destroying pests. The forest entomologist Shevyrev records that 50 families of starlings in the Berdinsk forest, during a mass attack of *Exaereta ulmi*, effectively replaced, for 3–4 weeks, hand picking and spraying by a gang of workers whose daily pay would have totalled 20–25 roubles.

24.4 (47.0) : 11.62. Sus, N. I. Agrolesomeliorativnӯe meropriyatiya i nauka v voennӯ i poslevoennӯ period. **[Measures for rural amelioration with the aid of forestry, and science during the war and post-war periods.]** *Byull. Inst. zern. Khoz. yu.-v. SSSR* No. 3, 1944 (3–13). [Russ.] H.S.B. [1789].

According to present incomplete data, gulley erosion in the European part of the U.S.S.R. totals 2–3 million ha., and sheet erosion 40–50 million ha. In some regions erosion is already dangerous in character. In the lower Volga region in the provinces of Saratov, Stalingrad and Astrakhan, erosive land is calculated as 57,130 sq. km. or 23 per cent. of the total area; in Kursk the seriously erosive area is 49,890 sq. km. or about 90 per cent. of the total area. Average yearly soil losses due to sheet erosion are 9–15 tons per ha. In Transcaucasia, losses of 20–50 tons per ha. have been observed, and in the province of Tula, in one instance 60 and in another the catastrophic figure of 130 tons per ha. were recorded.

Shelterbelts have already proved their usefulness in practice. Contour field shelterbelts are recommended for slopes, or complete afforestation of slopes where the soil is unsuitable for agriculture. Shelterbelts in flat dry regions are important as protection against drying winds and for their influence on soil moisture and regulation of snow cover and surface run-off. In steppe and forest-steppe regions these functions, and especially the effects of protection against soil freezing, are particularly important.

Experiments in the Kamennaya Steppe showed that during ordinary winters the soil in shelterbelts, under a snow cover 70–80 cm. deep, usually freezes for a very short time or not at all. According to data from Timashevsk, the deeper the snow cover, the shallower is soil freezing and the lower the coefficient of run-off, since soil freezing under thin snow cover, e.g. in open areas, prevents absorption of the water of thawing.

If shelterbelts are planted along the contours the snow drifts formed under their cover and on the windward side will impound water arriving from higher levels and retard its flow down the slope, thus, in the absence of definite gulleys, run-off will be evenly distributed and rapidly absorbed by the unfrozen soil. In experiments on comparative rates of flow of thaw water under snow of various depths in an open area between shelterbelts, the flow in open shallow runnels on a slope with a gradient of 3° was 0·03 m. per sec., while near by on the same slope but under 50 cm. of snow not saturated with water the flow in runnels was only 0·01 m. per sec. Where under-layers of snow were saturated with water, the rate of percolation did not exceed 0·002 m. per sec.; at this rate water would require 13–15 hours to pass under a snow drift 100 metres wide.

The primary conditions for the effectiveness of field shelterbelts as regulators of snow cover and surface run-off are distribution according to relief, adequate width, and the presence of well developed underwood and litter.

Erosion control measures will be especially important in the war-devastated areas.

24.5. *Pruning*

24.5. Enander, M. Iakttag försiktighet vid grön-kvistning! **[Be cautious with live pruning!]** *Skogen* 33, 1946 (64–6). [Sw.] [1790].

A series of photographs illustrating the occlusion of live-pruning wounds in several tree species. Damage is rare if the trees pruned are quick growers and have favourable environmental conditions. In case of doubt, a small-scale trial should be made before deciding to live-prune. [Cf. *For. Abstr.* 7 (No. 1781).]

24.51 : 12.25. Australia. **Annual report of the Commonwealth Forestry Bureau for year 1944.** Govt. Printer, Canberra. 1944. pp. 15. [1791].

In pruning Western Yellow Pine (*Pinus ponderosa*) it is possible to remove as many as 3, leaving 4 whorls of branches on 7-year-old trees, without reducing the diameter increment. At 9 years it was found that the trees required a minimum of 6 whorls, so again only 3 could be removed without affecting increment, though the effect of removing 4 was not serious. An additional experiment has been laid down in an 11-year-old plantation, leaving 5, 6 and 7 whorls respectively. [Cf. *For. Abstr.* 7 (No. 2097).]

3. FOREST UTILIZATION. FOREST TECHNOLOGY.

31. PROPERTIES AND ANATOMY OF WOOD. WOOD RESEARCH

31 : 31.4 : 33.36. HENDERSON, F. Y. **Timber: its properties, pests and preservation.** Crosby Lockwood and Son, Ltd., 20 Tudor St., London, E.C.4. 2nd ed., 1944. pp. 148. Price 10*s*. 6*d*. [1792].

Since 1939, when the first edition of this book was published [cf. *For. Abstr.* 1 (309)], there has been a great expansion in the use of timber and its products, particularly of plywood and its derivatives, and the text has been expanded accordingly where necessary. Chapters deal respectively with the following subjects: the tree; the structure of softwood, and of hardwood; how a log is cut up; texture, grain and figure; colour and odour; hardness and density; water in wood; the strength of timber; natural defects; durability and decay; destruction by animals; seasoning; preservation; notes on common timbers; timber identification; timber bending; veneers and plywood; the examination of woods for the presence of fungi. There are 61 illustrations, an index and a short bibliography.

31 : 38 : 33.36. HUDDLESTON, E. B. **Wood technology in engineering.** *Pamphl.* [*Leafl.*] *N.S.W. For. Comm. Div. Wood Technol.* No. 11, 1944. pp. 16. [1793].

An outline of the present state of knowledge of the properties of wood as an engineering material. Sections deal with moisture in wood, shrinkage, seasoning, stresses produced in seasoning, collapse, strength, preservation, specifications. One table gives comparable working stresses for New South Wales hardwoods (*Eucalyptus pilularis*, *E. eugenioides*, *E. microcorys*, *E. acmenioides*, *E. propinqua*, *E. saligna*, *E. maculata*, *E. tereticornis*, *E. rostrata*, *E. punctata*, *E. resinifera*, *E. longifolia*, *E. hemiphloia*, *Tristania conferta*) and *Pseudotsuga taxifolia*. Another table gives maximum and minimum percentages of moisture for different species at different stations in New South Wales.

31 : 33.15. TICKLE, C. G. **Timber research and industry in wartime.** *Timber News* 54, 1946 (12–4). P.R. [1794].

A brief review of some of the war-time research activities of the Forest Products Research Laboratory, Princes Risborough. Among the many subjects dealt with were the problems arising from the use of substitute woods; laminated woods and processing with particular reference to aircraft construction; box-making incidental to the packing of military stores, and damage to timber due to aerial bombardment and consequent dry rot and other troubles. A new laboratory, now nearing completion, will house machinery capable of making and testing plywood sheets of commercial size. With this new equipment it should be possible to collect interesting data on the ordinary plywoods of commerce.

31.0. *General Information on Woods*

31.0. **A craftsman must choose his wood.** *Ill. Carp. Build.* 135, 1946 (226). P.R. [1795].

Notes on characteristics and some uses of Oak (English and American, Red and White); Ash (English and American); Teak; Mahogany (Honduras and African), and Birch.

31.0 (67.2) : 33. Notice sur les principaux bois de l'A.E.F. et leur emploi. [**Note on the principal timbers of French Equatorial Africa and their uses.**] Service des Eaux, Forêts et Chasses, Gouvernement Général de l'Afrique Équatoriale Française. 1944. pp. 11. [F.] [1796].

The first part of this pamphlet consists of a table of the principal commercial species with their vernacular and scientific names and average density at 15 per cent. moisture content. The second part consists of a number of tables of the species classified according to the uses for which they are suitable, with notes on their general characteristics and colour.

31.0 (81). **Timber in Brazil.** Brazilian Government Trade Bureau, 551 Fifth Avenue, New York 17. 1945. pp. 25. P.R. [1797].

Characteristics, properties determined by the Institute of Technological Research, São Paulo, and tabulated statistical data on some of the timbers found in Brazil's billion acres of forests. Detailed notes are given on Brazilian Pine (*Araucaria brasiliensis*), and its by-products. Lists of timber, lumber and plywood exporters are appended.

31.0 (88) : 33.0. **Surinam timbers.** Agricultural Exp. Sta., Paramaribo, Surinam. pp. 39. I.F.B. [1798].

Short descriptions of 34 of the better known native timbers and information regarding their uses, together with vernacular names for the various species.

31.0 (97). **A handbook of Empire timbers.** H.M. Stationery Office, London. Revised ed., 1945. pp. vii + 142. [Forest Products Research Laboratory, Princes Risborough, Aylesbury, Bucks.] [1799].

Earlier editions of this handbook appeared in 1932 and 1939. The present edition has been revised and enlarged, and deals with some 30 more species than the earlier editions. The information given for each species includes general description of the tree and its timber, seasoning properties, wood bending properties, mechanical properties, natural durability, insect attack, preservative treatment, working qualities, uses, and supplies. Appendices give a number of kiln schedules, a tabular presentation of mechanical and physical properties of Empire timbers, and specifications for the teeth of circular saws for ripsawing the various timbers described.

31.0 : 12.26–8. **Specimen woods No. 122: Holm Oak** (*Quercus ilex*). *Suppl.* to *Wood* 11, 1946 (43–4). [1800].

31.0 : 12.26–8. **Specimen woods No. 121: Mufumbi** (*Entandrophragma utile*). *Suppl.* to *Wood* 11, 1946 (13–4). [1801].

The Mufumbi or Cedar (*Entandrophragma utile*) is a large deciduous tree, exeeding 150 ft. in height and often having a quarter-girth of 45 in. It has a wide range from West Africa eastwards to Uganda. The weight of the wood is usually not much short of 45 lb. per cu. ft. air-seasoned; it requires considerable care in seasoning as it has a tendency to warp and twist. The wood is harder and less fissile than Mahogany, but not really difficult to work.

31.0 : 12.26–8 (54.7) : 12.19. CHOWDHURY, K. A. **Further information on Red Cutch** (*Acacia sundra*): **a substitute for Lignum-vitae** (*Guaiacum officinale*). *Indian For.* 71, 1945 (367–8). [Forest Research Institute, Dehra Dun.] [1802].

The information given in this article on the distribution and properties of Red Cutch (*Acacia sundra*) was collected during April and May 1945, on a tour of Bombay Presidency and some of the adjoining Indian States. The localities visited were the Panch Mahals division, Baria and Rajpipla States, Dahanu and Kasa ranges of North Thana division and Bassein and Bhiwandi ranges of West Thana division. In all localities a few trees were in flower and it was possible to identify them as *A. sundra*. Some 50 samples of timber from different localities were collected and later examined in the laboratory. Most of the samples were suitable to serve as substitutes for Lignum-vitae, but some did not possess the necessary amount of gum. It appeared that timber above 10 ft. from the ground had not a high proportion of gum in its cells, and it is therefore doubtful whether timber high up in the bole will serve for the lining of tail-shaft bearings.

The following revised specification for Red Cutch is suggested:—

(1) Straight-grained and clean-boled Red Cutch (*Acacia sundra*) trees over 1 ft. in diameter should be selected. The larger the tree the better the timber. Hollow trees should not be selected.

(2) The best timber seems to come from trees with a low percentage of sapwood. Trees with sapwood more than one in. wide should, if possible, not be selected.

(3) One bolt 10 ft. long or 2 bolts 5 ft. long from the bottom, should alone be selected. The rest of the log appears to be unsuitable.

(4) On the end surface, the pores should be comparatively small and the rays fine.

Red Cutch appears to grow mainly on dry sites on rocky soil. The main crop is Teak with scattered Red Cutch and a few other species such as *Bassia latifolia*, *Terminalia tomentosa*, *Anogeissus latifolia* and *Sterculia urens*. The rainfall is 35–40 ins. in Baria State and Panch Mahals division. In other localities in Bombay Presidency rainfall is heavy, but the soil is physiologically dry laterite.

31.0 : 12.26–8. **Specimen woods No. 120: Banak** (*Virola koschnyi* **Warb.**). *Suppl.* to *Wood* 10, 1945 (303–4). [1803].

This tree ranges from Panama to British Honduras and Guatemala. It often attains a height of 90 ft. or more and has a smooth bole varying from 6 to 36 ins. in quarter-girth. The wood is pinkish-brown, of medium weight (35–40 lb. per cu. ft., air dry) and hardness, medium texture, and straight grain. Care is necessary in seasoning to prevent splitting and distortion. Strength properties are commensurate with weight. It is not resistant to rot and is very susceptible to pin-worm and sap-stain.

31.1. *Structure. Anatomy. Identification*

31.1. Isenberg, I. H., and Buchanan, M. A. **A color reaction of wood with methanol-hydrochloric acid.** *J. For.* 43, 1945 (888–90). [Institute of Paper Chemistry, Appleton, Wis.] [1804].

Tests made with 277 species belonging to 56 families have shown that methanol containing a small amount of hydrochloric acid gives a purple colour when mixed cold with shavings of some species, and not with others. The method gives promise of making it possible to identify the woods of certain species that cannot be separated on the basis of structure alone. Preliminary results of this method are: In the genus *Acer* all the species examined, except *A. negundo* and its varieties, gave an intense colour in a short time, a reaction which may be of taxonomic significance, for *A. negundo* is the only American species of the genus which has compound leaves. In the genus *Quercus*, the species in the Red Oak group, with several exceptions, gave the purple reaction in both sapwood and heartwood, whereas the White Oak group did not give it in the heartwood and only a few species gave it in the sapwood. Sapwood of Shortleaf Pine gave a purple colour in a short time and sapwood of Loblolly Pine did not.

It might be possible, in some species where sapwood and heartwood are indistinguishable, to separate those portions, if one or the other gave the purple test. Further studies will be directed towards the determination of the component in the wood which is responsible for this reaction with methanol-hydrochloric acid, its location in the cellular structure, the use of the test in wood identification and how such wood components may cause colour difficulties in the pulp industry. The authors will be glad to correspond with anyone desiring further information on the tests.

31.1 : 56.02. Wiksten, Å. Metodik vid mätning av årsringens vårved och höstved. [**Methods of measuring spring- and summerwood in the annual ring.**] *Medd. Skogsförsöksanst. Stockh.* 34, 1944–45 (451–96). [Sw.sw.e.] [1805].

Measurements under the microscope of about 3,600 cells of Spruce and Pine confirmed the value of Mork's definition of the boundary between spring- and summerwood. As now more strictly defined by the present author, the rule for both species is to reckon as summerwood that portion of an annual ring in which twice the thickness of a tangential common cell wall is consistently equal to or greater than the radial interior width of the lumen. Where the ratio lumen/wall does not approach the value 2 : 1 the alternative rule is to take as summerwood the portion in which the ratio tangential section of cell/radial section of cell consistently equals or exceeds 1·10 : 1. Where possible the first alternative should be employed as being more constant and easier to determine.

When numerous measurements are needed, a simple, rapid method, with no sacrifice of accuracy is desirable. To this end a method of staining has been devised to secure maximum contrast between the springwood, which takes up stains, and the summerwood, which does not. The procedure is: (i) Increment cores are soaked in water at 15–20° C. for 10–12 minutes. (ii) The cores are cut with a sharp knife to expose a perfectly smooth, even surface for measurement. (iii) The exposed surface is painted with a solution of 0·015 g. each of methylene blue and malachite green in 25 cc. of an aqueous alcohol solvent the strength of which is varied according to type of wood to be examined. For Spruce (and Pine—in parenthesis) the required percentages of alcohol in the solvent are (*a*) for rapid-grown wood (rings wider than 2 mm.) near the pith, 5–7·5 (17·5–22·5); (*b*) for sapwood, 7·5–12·5 (22·5–27·5); (*c*) for heartwood, 12·5–17·5 (25–30). The lower concentrations are applied to wood with relatively broad annual rings. The stained cores are then measured for summerwood in a special apparatus, described by Näslund [*Medd. Statens Skogsförsöksanst.* 33, 1942 (20–2)], under a magnification of 20×. Tests of this method against accurate measurement under the microscope showed an entirely satisfactory degree of accuracy. [Cf. *For. Abstr.* 7 (No. 2098).]

31.1 : 12.2. **Queries for taxonomists.** *Trop. Woods* No. 84, 1945 (24–5). [1806].

Reasons based on wood anatomy are given for revising the classification of *Symplocos tinctoria* (L.) L'Hér., *Daubentonia texana* Pierce, the genus *Illicium*, *Ravenia rosea* Standl., *Senegalia angustifolia* (Lam.) Britt. and Rose.

31.1 : 12.25–8 (4). Schmidt, E. Mikrophotographischer Atlas der mitteleuropäischen Hölzer. [**Microphotographic atlas of Central**

European woods.] *SchrReihe Reichsinst. ausl. kolon. Forstw.* No. 1, 1941. pp. 112. [G.E.] L.C. [1807].

Short descriptions are given in German and English of the macroscopic and microscopic characters of 9 coniferous woods and 49 hardwood timbers of Central Europe, with standard microphotographs of transverse, tangential and radial sections.

31.1 : 12.26–8 (59.1). CHOWDHURY, K. A., GHOSH, S. S., and TANDAN, K. N. **An index of the series 'How to identify timbers', Parts I–VI.** *Indian For. Leafl.* (*Utilization*) No. 80, 1945. pp. 8. [Forest Research Institute, Dehra Dun, U.P.] [1808].

31.1 : 12.26–8 (9). AUSTRALIA. **Council for Scientific and Industrial Research, Division of Forest Products: annual report for the year 1944–45.** Forest Products Laboratory, 69–77 Yarra Bank Road, South Melbourne. 1945. pp. 43. [1809].

The investigation of the timbers of the South-west Pacific has formed the main work of the Wood Structure Section [see *For. Abstr.* 7 (No. 1198)]. In the course of this, it was found that more information was needed on the anatomy of the various members of the family Meliaceae occurring in the area. All specimens of this family collected in New Guinea and all available specimens from other islands of the South-west Pacific area were, therefore, re-examined, and an attempt was made to place them in a number of groups based on wood anatomy. The relation of these groups to general botanical classifications cannot be determined until the botanical side of the work has been completed by the Government Botanist, Brisbane (pp. 4–5).

31.2. *Physical Properties*

31.23. Specific Gravity

31.23 : 07.7. STERN, E. G., and DEAR, P. S. **A simplified method for the determination of the specific gravity of wood and plastics.** *Bull. Amer. Soc. Test. Mat.* No. 135, 1945 (35–40). P.O. [1810].

Using a mercury-balance volumeter, a method is suggested for simplifying the recommended A.S.T.M. methods for determination of the specific gravity of wood and of solid plastics. Comparison is made of test data for Yellow Poplar and Tenite, obtained according to the various methods employed. It was found that, by using this new method, data for test specimens as small as 2 × 2 × ½ in. were as accurate as A.S.T.M. Standard Method for Wood requiring test specimens 2 × 2 × 6 in. Small samples, cut from undestroyed parts of specimens previously tested for physical and mechanical properties, or rough, unfinished specimens of any shape, can be used. Covering of wooden specimens with a wax film before immersing them in water, as required by A.S.T.M. method for wood, is unnecessary; as immersion in water is eliminated, swelling of the specimens cannot occur.

31.23 : 31.22.2 : 12.26–8. LIMBACH, J. P., and PAUL, B. H. **Variation in the specific gravity of Balsa and its relation to longitudinal shrinkage.** *Trop. Woods* No. 84 1945 (18–23). [1811].

See *For. Abstr.* 7 (No. 1212).

31.27. Mechanical Strength

31.27 : 01.6 : 38. **List of publications on mechanical properties and structural uses of wood and wood products.** *Mimeo. U.S. For. Prod. Lab., Madison. R*200, 1945. pp. 38. P.R. [1812].

A revised list of publications giving general information and the results of research on the strength of timbers and factors affecting strength; design of wood articles and of parts where strength or resistance to internal force is of importance.

31.27 : 11.11 : 31.22.1 : 33.15. AUSTRALIA. **Council for Scientific and Industrial Research, Division of Forests Products: annual report for the year 1944–45.** Forest Products Laboratory, 69–77 Yarra Bank Road, South Melbourne. 1945. pp. 43. [1813].

An investigation has been in progress for some time on the effect of high and low temperatures on the strength of wood, plywood and glued joints. The preliminary tests were made only at a moisture content of 15 per cent., but tests have now been extended to a wide range of moisture contents, and the later results confirm and extend those already published. When expressed as a percentage of the crushing strength at 20° C. the weakening effect of temperature per degree C. for all species examined varied from about 0·3 per cent. at 0 per cent. moisture content to about 1 per cent. at 20 per cent. moisture content, thereafter decreasing to about 0·7 per cent. at fibre-saturation point. It is thus possible to predict with considerable accuracy the effect of temperature on the maximum crushing strength of any species at any moisture content. In static bending, the modulus of rupture and modulus of elasticity decreased with increasing temperature at all moisture contents from 8 per cent. to 20 per cent. In toughness, no serious weakness was experienced, in fact the general effect was a marked increase at high temperatures and high moisture contents. The same type of result was, in general, obtained with plywood in compression tests. In tension tests, however, the effect of temperature varied considerably with moisture content and over different temperature intervals. Considerable reduction in strength occurred at temperatures above 50° C. at high moisture content, and this was particularly serious when the direction of the grain of the outer plies was at 45°. The danger of ignoring temperature corrections in structural design, particularly of aircraft, is thus well demonstrated (p. 16).

31.3. *Chemical Properties*

31.3. GRIFFIOEN, K. Eenige onderzoekingen over de aanwezigheid van ware lignine in plantenmaterialen. [**Investigations on the presence of true lignin in plant materials.**] *Repr.* from *Chem. Weekbl.* 36, 1939 (81–5). [Du.] L.C. [1814].

Data are included on the lignin, cellulose and pentosan content of samples of Fir wood [*Abies alba*], rye straw, Beech wood [*Fagus sylvatica*], and sunflower stems (tip and base) after treatment with alcohol-benzol, with water, and with dilute sulphuric acid.

31.3 : 12.26–8. AUSTRALIA. **Council for Scientific and Industrial Research, Division of Forest Products: annual report for the year 1944–45.** Forest Products Laboratory, 69–77 Yarra Bank Road, South Melbourne. 1945. pp. 43. [1815].

Exhaustive studies have shown that under the most drastic conditions, only one half of the lignin in Eucalypt wood can be extracted by means of methanol. Addition of hydrogen chloride to the methanol, as a catalyst or hydrolytic agent, facilitates the extraction of one-half of that which is insoluble in pure methanol. The remainder, i.e. one quarter of the original lignin, resists all attempts, short of complete hydrolysis of the carbohydrate fraction, to extract it (pp. 10–11).

31.3 : 31.43 : 31.28. BESSON, A. Richesse en cendres et teneur en silice des bois tropicaux. [**Richness in ash and silica content of tropical woods.**] *Agron. trop.* 1, 1946 (44–56). [F.] [Laboratoire de Chimie de la Section Forestière, Ministère des Colonies.] [1816].

The study described in this article arose out of two practical questions: the resistance to teredo attack of certain tropical woods used in marine construction, and the difficult working properties of certain species. The latter class of woods were found to be rich in silica, which had a blunting effect on saws. Tests were made on 150 specimens of tropical woods, to determine their ash content and richness in silica. Only one specimen was tested for most species, and the author points out that more specimens might give different results. Tropical species have on the whole a much higher ash content than that of temperate species, which never reaches 1 per cent. and seldom exceeds 0·5 per cent. Some tropical species, on the other hand, have an ash content of 2, 3, and even 4 per cent. Of the 150 specimens tested, 20 per cent. had more than 2 per cent. of ash, and 23 per cent. had between 1 and 2 per cent. On the whole, the softer woods were found to be richer in ash and silica than the harder woods, but there are striking exceptions to this. Botanical classification was no more helpful; in one family there may sometimes be found a whole range of values for silica content, or at least a minimum and maximum widely separated. Some families, however, have a certain homogeneity in this respect: the Rosaceae appear to be rich in ash and the Sapotaceae very poor.

There appears to be no positive correlation between ash content and richness in silica, but examination of graphical representations shows that siliceous woods are generally rich in ash; an average silica value corresponds to an average quantity of mineral substances, and in the case of woods with very little silica one encounters highly mineralized specimens.

There are 3 diagrams representing graphically the ash and silica content of more than 80 of the specimens examined, and a tabular list of all species tested, giving provenance, vernacular and scientific names, ash content and silica content of (1) the ash, (2) the whole wood. [Cf. *For. Abstr.* 7 (No. 1236).]

31.4. *Durability. Decomposition*

31.42. Attack by Plant Organisms

31.42.11 : 12.21 : 33.36 : 38.2. Hirt, R. R., and Lowe, J. L. **Danger of decay in poorly seasoned lumber.** *J. For.* 43, 1945 (717–8). [New York State College of Forestry, Syracuse, N.Y.] [1817].

The writer describes two cases in which the use of insufficiently seasoned timber in the construction of modern houses led to rapid and serious decay from the fungus *Poria microspora*. The insulation of modern houses tends to create poorly ventilated spaces within the walls and thereby hinders the rapid drying of structural timber placed in service while still insufficiently seasoned. When the loss of moisture is blocked by a vapour barrier such as asphalt paper, humidity within such areas may reach a dangerously high concentration very favourable to the spread of certain decay fungi.

31.42.11 : 12.26–8 : 31.8. Gäumann, E. Über die Pilzwiderstandsfähigkeit des roten Buchenkernes. [**The resistance to fungal attack of the red heartwood of Beech.**] *Schweiz. Z. Forstw.* 97, 1946 (24–33). [G.f.] [1818].

An 8-month decomposition test, using *Polyporus vaporarius*, *Coniophora cerebella*, *Polystictus versicolor* and *Stereum purpureum* as test fungi, showed that, for the same stem, the resistance of red heartwood to attack by all 4 fungi was in all cases greater than that of normal white heartwood, decomposition of samples of the former averaging 62 per cent. of that of the latter. The difference, however, was not an absolute one between red and white heartwood as such, since white heartwood from a given stem could be more resistant than red from another. Resistance thus varies within the stem and from one stem to another, which presumably explains some apparent contradictions in results reported in literature, a possible further contributing factor being that resistance probably varies also with stages in the development of red heart, increasing with this process to a certain point and then once more decreasing with age. The latter supposition, though not yet experimentally proved, is supported by practical observations.

31.42.12 : 31.3 : 12.25. Rennerfelt, E. Inverkan av tallkärnvedens fenolsubstanser på några blåytesvampars tillväxt jämte ett försök till kvantitativ mätning av blånadens intensitet. [**The influence of the phenolic substances of Pine heartwood on the growth of certain bluing fungi, with an attempt at quantitative measurement of the intensity of bluing.**] *Medd. Skogsförsöksanst. Stockh.* 34, 1945 (391–416). [Sw.e.] [1819].

Two natural constituents of Pine heartwood —pinosylvin and pinosylvin monomethyl ether —previously found toxic to wood-rotting fungi in agar [see *For. Abstr.* 5 (184); 6 (169, 224)], proved to have a considerable inhibiting effect in the same medium on the bluing fungi *Cladosporium herbarum*, *Ophiostoma* sp., *Phialophora fastigiata* and *Stemphylium graminis*, pinosylvin being somewhat the more toxic of the two. To investigate the toxicity of both substances in wood, Pine sapwood blocks were impregnated with alcoholic solutions of each, sterilized, and then infected with spore suspensions of the same fungi and left for 4 weeks. On simultaneously infected sapwood controls all fungi grew well but showed very different capacities for pigment formation, *S. graminis* forming the most, and *Ophiostoma* the least pigment. Impregnated sapwood gave considerably reduced pigment formation, and the latter decreased with increasing concentration of the phenolic substances. To secure corresponding inhibition of growth, a higher concentration was required than in agar, and even so, heartwood controls, in some cases containing less pinosylvin than the impregnated sapwood, still showed the greatest inhibition of fungal development, indicating that other factors in the heartwood must play an important part. On sapwood controls discoloration increased rapidly from the first to the third week, subsequent discoloration being slow or even decreasing. In spite of the strong inhibition of fungal growth, sapwood impregnated with pinosylvin monomethyl ether showed the same trend, *P. fastigiata* giving the greatest discoloration in this case.

Besides visual estimation, a method of measuring discoloration was used that involved comparison of results for the wood samples with those given by a series of briquettes of standard pigmentation, using the General Electric Reflection meter or Brightness Tester. A standard pigment unit is proposed and defined on this basis. The method gave considerably more objective and finer discrimination of colour values than was possible with visual estimation, and some such method is urgently required, as the practical importance of bluing fungi lies chiefly in the discoloration of wood and wood products.

31.43. Attack by Animal Organisms

31.43 (42.1–8) : 12.26–8 : 13.2. GREEN, W. J. **Damage by death watch beetle to the roof-timbers of York Minster.** *Wood* 11 (1), 1946 (3–6). [1820].

An account is given of the operations started in 1935 and interrupted by the war, for the restoration of the 13th-century Oak roof of the north transept of York Minster, which was found to be badly attacked by Deathwatch Beetle. The centre ribs are more than 90 ft. above the ground and a scaffold had to be erected of this height, sufficiently rigid to support itself without assistance from the walls of the transept and also strong enough to support the weight of the ribs and centering. The ribs and bossses were taken out, immersed in a tank of insecticide and dried before being reassembled. The application of insecticide to large timbers in inaccessible places is impracticable and of doubtful use, though the successive application of insecticide at the right season of the year to small timbers within easy reach has proved successful. The roof of the choir of York Minster, though quite close to the north transept, is totally unaffected by the beetle; it is of Teak and replaced the original roof when it was burnt in 1829.

31.8. *Quality and Defects of Timber*

31.8 : 31.1. AUSTRALIA. **Council for Scientific and Industrial Research, Division of Forest Products: annual report for the year 1944–45.** Forest Products Laboratory, 69–77 Yarra Bank Road, South Melbourne. 1945. pp. 43. [1821].

Further investigations have been carried out on tension wood in *Eucalyptus regnans* and other hardwoods. Individual fibres from tension-wood areas have been isolated and their structure and behaviour during swelling compared with normal wood fibres from the same tree. In co-operation with the Commonwealth Forestry Bureau, the amount and type of tension wood present in bent stems of *Drimys* and *Gnetum* have been examined. It was found that the excentricity in *Drimys* was similar to that observed in coniferous woods, while the excentricity in *Gnetum* was similar to that observed in hardwoods (pp. 6–7).

31.8 : 12.25 : 31.1. FREY-WYSSLING, A. Über zugewachsene Harztaschen der Fichte. **[On occluded resin pockets in Spruce.]** *Schweiz. Z. Forstw.* 97, 1946 (112–9). [G.g.] [Pflanzenphysiologisches Institut der Eidg. Technischen Hochschule, Zürich.] [1822].

Abnormal resin pockets in wood of a Spruce from Savognin (Grisons), with ingrowing resin galls consisting of special pocket tissues representing wood, cambium, bast and bark, are described and figured, and compared with normal resin pockets. It is probable that the inner abnormal cambium is separated from the outer, normal cambium and continues to function as a result of injuries to the secondary meristem during the formation of resin cracks and the consequent development of traumatic wood.

31.8 : 12.26–8 : 31.1. BURGER, H. Der Drehwuchs bei Birn- und Apfelbäumen. **[Twisted growth in Pear and Apple trees.]** *Schweiz. Z. Forstw.* 97, 1946 (119–25). [G.f.] [Schweizerische forstliche Versuchsanstalt.] [1823].

Examination of 3,843 Pear and 3,446 Apple stems in the Swiss midland plateau showed that of the former 11 per cent. had a left-handed twist, 19 per cent. were straight, and 70 per cent. twisted to the right. The tendency to a right-handed twist increased with increasing age and diameter, e.g. in the 10–20 cm. class 42 and in the classes over 50 cm. in diameter 77 per cent. showed a right-handed twist. Of the Apple stems 44 per cent. were left-handed and 31 per cent. right-handed in twist; in the 10–20 cm. class only 16, but in the classes over 50 cm. 63 per cent. were left-handed; thus in this species the tendency was the opposite to that in Pear. These phenomena appeared to be uninfluenced by site. It may be possible later to report a similar contrast in different groups of the genus *Pinus*. [Cf. *For. Abstr.* 4 (110)].

31.8 : 31.4 : 32.3 : 4. KNUCHEL, H. Holzfehler. **[Defects of timber.]** Buchdruckerei Büchler and Co., Bern. 2nd ed., 1940. pp. 144. [G.] [1824].

A fully revised edition, on the same general lines as its predecessor of 1934. Defects, with hints on avoiding them, are considered for European timbers under the main headings: (i) Stem form (crookedness, forking, taper, etc.). (ii) Anatomical (irregular annual rings, red compression wood of conifers, twisted growth, resin pockets, false heartwood, knots). (iii) Due to injuries (*a*) by atmospheric agencies (different types of shake and checking; lightning, hail, snow and storm damage; bark scorch); (*b*) by man (general, felling, transport, stacking and sorting, storage, influence of felling season); and (*c*) by plants and animals. The booklet is illustrated with numerous photographs.

32. HARVESTING OF WOOD: LOGGING.

32 (410) : 81. **Meet the members: a record of the Timber Corps of the Women's Land Army.** Home Timber Production Department, Ministry of Supply. [1945.] pp. 76 + plates. Price 2*s*. 6*d*. [1825].

The Women's Timber Corps, founded in 1942, did valuable work during the war. It was at first intended that its members should be employed only on measuring, acquisition work, selection and census, but later they were also successfully employed in felling light timber, haulage and sawing. The strength of the Corps reached about 5,000. This book deals with the various types of work in the form of personal stories written by members of the Corps, e.g. on acquisition, pole selection, felling, preparing pitprops, haulage, sawmilling, measuring, census, Alder Buckthorn, stocktaking. There are also accounts of camp and hostel life.

32 : 07.7 : 32.96. Basov, M. I. Tekhnologicheski protsess lesozagotovok. **[The technology of logging operations.]** *Lesnaya Ind.* No. 12, 1940 (19–20). [Russ.] [1826].

Stress is laid on the following points necessary to avoid delay during loading and unloading operations: (i) Before the work begins, the wood should be divided into felling areas, the shortest possible routes marked for skidding, and suitable log dumps reconnoitred. (ii) Felled wood should be piled in heaps of not less than 2–3 cu.m. along the skidding paths. (iii) Correct stacking at the initial log dumps to prevent the timber collapsing when loading is done. Large stacks about 5 m. high should be built. Horse derricks are recommended for stacking and loading, and power derricks where timber is to be loaded on to motor trucks and motor sleighs in winter. (iv) For unloading and stacking the wood at the depot large derricks should be used.

32.1. *Marking of Trees and Coupes*

32.1 : 12.25. Orr, T. J. **Selective marking in Ponderosa Pine on a Klamath Falls tree farm.** *J. For.* 43, 1945 (738–41). [Weyerhaeuser Timber Company, Klamath Falls, Ore.] [1827].

The principal aim of the marking system described is to distinguish effective growing stock from trees which have achieved their growth or are already overmature and decadent. Detailed rules are given, together with an indication of stand conditions and individual tree characters which may call for their modification. Keen's slide-rule is used to determine which mature trees should be retained, but the man marking timber is expected to use his judgment in applying the rules. More than 200 million ft. of timber has been marked for cutting under this system. The remaining stand averages about 25 per cent. of the original volume and is of uniformly thrifty appearance. Initial losses from windthrow and bark beetle are very low.

32.2. *Felling and Related Operations*

32.2 (44) : 07.7 : 33.17. Blais, R. Aperçus sur l'organisation et l'équipement des entreprises d'exploitation forestière et des scieries. **[Observations on the organization and equipment of logging operations and sawmills.]** *Rev. Eaux For.* 83, 1945 (16–34). [F.] [1828].

The author describes the organization and equipment generally used in France in felling operations, and discusses the possibility of increased mechanization, by the use of power-driven circular or chain-saws for cross-cutting in the forest. He concludes that mechanization is impracticable in forests growing on slopes and those in which partial fellings are carried out, which is notably the case of broadleaved high forest. It is only practicable in clear felling of coppice or of coniferous forest, and even then has the disadvantage of confining the skilled woodcutter to work with the axe, which is tiring and ought to alternate with conversion operations.

The second part of the article deals with the equipment and organization of sawmills, both stationary and mobile. The majority of French sawmills are small or of medium size, and the writer concludes that there is no reason why such establishments should not possess all the existing technical improvements, though at the present time much of the equipment is old-fashioned or worn out.

32.2 : 07.7. Campredon. Au sujet d'essais d'abatage des arbres et des taillis à l'aide de scies mécaniques. **[Experiments in felling trees and coppice with the aid of mechanical saws.]** *Rev. int. du Bois* 13, 1946 (20–1).

[F.] [Laboratoire Central d'Essais des Bois, Paris.] [1829].

An account of experiments in felling and cross-cutting with mechanical saws, carried out by the Laboratoire Central d'Essais des Bois. Trees were felled with a 1-metre saw driven by a 9-h.p. engine using 1·75 litres of petrol an hour and weighing 75 kg. Workmen unaccustomed to the work felled a Birch with a girth of 1·50 m. in 1 min. 30 sec., while skilled woodsmen took 15 minutes to fell by hand a similar tree. For conversion of cordwood, a 30-cm. saw, driven by a 3-h.p. engine and weighing 20 kg. was used and the production amounted to 1 stacked cu.m. per man in 84 minutes, compared with 1 stacked cu.m. per man in 130 minutes by hand. Results in felling coppice were less significant and further experiments should be made on a larger scale.

32.25 : 07.7 : 24.3. BELCHER, R. G. **Power saws for improvement cuttings.** *J. For.* 43, 1945 (769–70). [1830].

In many second-growth areas, 'wolf trees' occur in stands which are accessible and can be thinned to good advantage, but they are left standing because the cost of labour is too high to make their removal economic. The writer urges that such trees can be felled cheaply and quickly by the use of a power chain-saw, and cross-cut on the spot for either sawlogs or firewood. The power saw will also be found of value for thinning. To make the chain saw work economically calls for good foremen, careful organization and sound planning. The writer, together with a mill supply salesman and one very sceptical lumberjack, produced over 1,500 bd. ft. of logs (International ¼-in. rule) from a White Pine left by loggers because it had 4 main trunks starting at the top of the 12-ft. butt log. White Pine sawlog production at the rate of 5,000 bd. ft. per man per day by such a crew from such timber, shows how mechanization may produce economic products from sources neglected by hand labour.

32.25.4 : 82 : 33.06 : 07.7. ZEHNDER, J. Über das Einschneiden von Brennholz mit Wald- oder Scheitersägen. **[On the cutting of fuelwood with cross-cut saws or bow and hand frame saws.]** *Schweiz. Z. Forstw.* 96, 1945 (171–6). [G.] [1831].

The number of minutes taken to convert 1 stacked cu.m. of fuelwood from Spruce tops, 3–10 m. long and 11–18 cm. mid-diameter, varied with type of saw as follows:—(i) Bow-saw (1 man): total time 42·0, actual sawing time 19·8. (ii) Cross-cut saw (2 men): total 28·8, sawing time 11·6. (iii) Wooden frame-saw (2 men): total 26·6, sawing time 13·7. The figures for (iii), however, are not strictly comparable. Performance with bow-saws decreased and that with the cross-cut saw increased with increasing diameter, the performance curves intersecting at about 18 cm. diameter. The considerable variation in time other than actual sawing time is in part explained by the lack of occupation for two men during preparatory work. One man, however, cannot conveniently handle logs larger than 10 m. long and 14–20 cm. in diameter: up to this size the bow-saw appears the most advantageous.

32.25.5 : 07.7. Ny svensk barkningsmaskin. **[New Swedish barking machine.]** *Skogen* 33, 1946 (13). [Sw.] [1832].

The essential feature of Åström's barking machine is that logs are fed, horizontally and without rotating, between 4 chains attached to a rotating wheel. The latter consists of two rings: an outer one carrying springs to each of which one end of one of the chains is attached, and an inner one to which the other end of each chain is fastened. The outer ring is able to move ¼ rotation free of the inner one, so that on rotation the chains tighten round the log but sufficient 'give' remains for crook, etc. By this means the bark is rubbed off without damage to the wood, and tension on the chains can be adjusted to different degrees of difficulty of barking. The rate of feed is regulated by a 4-speed gearbox. The model at present manufactured, designed primarily for pulpwood up to 15 in. at the butt, weighs about 6,000 kg. inclusive of base and electric motors, works at 275 revs. per min., and will turn out 300 5-m. logs per hour at this speed, with a power consumption of 25 h.p. A heavier model for sawtimber up to 25 in. at the butt, and a lighter type which should be suitable for smaller works and probably for installation at assembly points on waterways, are to be manufactured.

32.8. *Grading and Storage of Wood in the Rough*

32.81 (44). SILVY-LELIGOIS, P. Première étude sur les bois de qualité exceptionelle: définitions et classements. **[First study of woods of exceptional quality: definitions**

and grades.] *Rev. Eaux For.* 83, 1945 (627–40). [F.] [1833].

The much increased use in France during the war of home-grown timber, especially softwoods from the Vosges, has led to tentative efforts at establishing a proper system of grading. The following main classes are recognized (1) exceptional quality (for aircraft construction and cabinet making), (2) carpentry and joinery quality, (3) building quality, which are further sub-divided. The article defines the terms used in the process of classification and gives in tabular form the official specifications so far established for native softwoods and hardwoods.

32.81 (931) : 33.1. NEW ZEALAND. **State Forest Service: annual report of the Director of Forestry for the year ended 31st March, 1945.** Govt. Printer, Wellington. **1945**. pp. 35. [1834].

Substantial progress has been made in the development of grading rules to cover framing timbers. As a basis for these rules it has been necessary to introduce the conception of 'cuttings', i.e. the standard-length building members obtainable from random-length timber, which is thus graded according to its ability to produce such cuttings. For 'cuttings' to be used as studs in non-bearing walls or for members not subjected to direct bending or compressive stresses, 50 per cent. of any cross section free of defects has been regarded as the acceptable minimum. For those to be used as rafters, ceiling joists, and studs for exterior or load-bearing walls, all of which are subjected primarily to bending and tension stresses, at least two-thirds of any cross section must be free of defects (p. 15).

32.82 : 33.36.3 : 33.06. KLEM, G. G. Tørke- og lagringsforsøk med brenneved. **[Drying and storage experiments with fuelwood.]** *Medd. norske Skogforsøksv.* 8 (No. 30), 1944 (475–516). [Nor.e.] [1835].

Satisfactory fuelwood should have a moisture content of 20–25 per cent. of the dry weight of the wood. The course of drying to this moisture content is described for 60-cm. cleft billets of Spruce and Birch cut in March, July and October, and stacked in the open, with or without a paper ('Pergaloid') covering, or in a shed.

For wood stacked in the open, on a proper foundation on dry ground, with free air circulation, the best drying months were April–June inclusive. Under such conditions Spruce cut in March had reached the appropriate moisture content by the end of June, whereas Birch took until the end of July; even so, the moisture content of Birch was somewhat higher and did not reach that of Spruce until June of the succeeding year. After reaching moisture contents between 20 and 25 per cent. in the first 3–4 months, neither species showed significant drying during the summer period, but the material was fit for use in the first winter after cutting. When cut in July or October, material of both species was insufficiently dry for use in the following winter and became so only in June–July of the second year.

In general, precipitation had little effect on the moisture content of the wood after drying (to 20–25 per cent. moisture) had taken place. During the autumn and winter months there was a slight regain of moisture, particularly in the uncovered stacks, owing to higher humidity in this period.

Practically no difference existed between the drying rates of wood stored in a shed and of that stacked in the open with a paper covering, and between these two methods and stacking with no covering the differences were also surprisingly small. Thus, provided that stacks, spaced at least 60 cm. apart, are built on good foundations on dry open ground free of weed growth, there is little to be gained from the use of coverings. Storage sheds are often quite unnecessary. If it is thought worth while to reduce the moisture regain in autumn, coverings can be made of paper, slabs or other cheap materials. Nothing is gained by covering until the end of August or somewhat later, and covering should be done after several days of dry weather. If the wood is to be used or dispatched to a consumer during the winter, coverings have the advantage of keeping off ice and snow, thus making handling easy.

32.9. *Transport*

32.91 (66.4). DUFFELL, R. **Timber extraction in Sierra Leone.** *Wood* 11, 1946 (48–50). [1836].

The extraction of heavy timbers from the bush in Sierra Leone is a matter of considerable difficulty. This article consists chiefly of photographs showing how the extraction of Ekki [*Lophira procera*] was effected by a Forestry Company of Royal Engineers, by making use of natural chutes before tractors were available, and later with tractors. The pole wagon used was an ordinary Service 3-ton Bedford OY chassis with an improvised trailer. It stood up well to the work and seldom carried less than 6 tons. It had no uphill work under load, or double driving wheels would have been necessary. It was found that the amount of wear and tear on men and machines during the rainy season was disproportionate to the results achieved and it is better to close down until drier weather returns.

32.91 : 32.26. PROKOV'EV, B. M. Novaya skhema trelevki. **[New skidding plan.]** *Lesnaya Ind.* No. 12, 1940 (27–9). [Russ.] [1837].

A plan for rationalized handling at log dumps, presupposing mechanized skidding and bundling, is briefly described. Sorted logs should be of the same length so far as possible, arranged alternately butt-to-top, since (i) bundles of conical shape with butts all in the same direction are inclined to slip during stacking, and a stack made of such bundles would be insecure; (ii) if the bundles are made with any considerable variation in length of log, short logs will eventually fall out.

Bundles should be made with logs differing in length by not more than 1–1·5 m., or where this is impossible, the short logs should be placed either in the middle or in the upper layers of the bundle. Butt-to-top bundling of logs should be done directly at the log dump, whether the timber arrives there as sorted or as long logs. Two alternative methods are detailed of enabling timber skidded to a given stack, to arrive from opposite directions in order to facilitate immediate butt-to-top bundling prior to stacking.

32.91.1 : 07.7 : 82. ZEHNDER, J. Ein Zugkraftmesser für das Holzrücken. **[A dynamometer for skidding studies.]** *Schweiz. Z. Forstw.* 97, 1946 (51–4). [G.] [1838].

The Swiss Forest Research Institute has used a dynamometer produced by A. J. Amsler and Co., Schaffhausen, which consists of an oil pressure vessel with a flexible pressure tube leading to a recording apparatus where the traction force can be either read off direct or recorded on a rotating drum. Carrying the recording apparatus on the horse or on a man walking alongside was found to give unsatisfactory results, and a wheeled mounting for the apparatus has now been devised. The mounting, which is figured, has a vertical member on which the dynamometer is hung and is free to move vertically. The pull necessary to move the mounting, which is transmitted through the vertical member, is less than 5 kg. One wheel of the mounting actuates the recording drum by means of a pulley drive, the rotations of the drum thus bearing a constant relation to the distance travelled. The pull on the forward end of the dynamometer is taken up by a spreader with two traces direct to the horse's collar.

32.91.22 : 32.96 : 07.7. UGGLAS, C. AF. Direkttransport av ved. **[Direct transport of fuelwood.]** *Skogsägaren* 21, 1945 (225–7). [Sw.] [1839].

The ability of wood to compete with mineral fuels depends largely on production and transport costs, and methods that eliminate reloading should bring considerable savings. Transport direct to the consumer by tractor-drawn sledge, or the use of jeeps to tow loads of wood, are considered worth trying.

32.92–4 (485) : 8 : 92. Betänkande angående flottningsväsendet och flottningslagstiftningen. **[Report on timber floating and timber-floating legislation.]** *Svenska SkogsvFören. Tidskr.* 44, 1946 (77–85). [Sw.] [1840].

A report on the proposals of the Forestry Board for certain reforms in the administration of timber floating in Sweden.

32.92–4 (485) : 09.4. Flottningen under 1944. En redogörelse för de allmänna flottlederna.—Preliminära uppgifter for 1945. **[Timber-floating, 1944. A report for the public waterways.—Preliminary data for 1945.]** *Skogen* 33, 1946 (41–3). [Sw.] [1841].

32.96 : 07.7. LESHKEVICH, A. I. Pod'emnik Solonitsȳna. **[Solonitsȳn's hand lifting tongs.]** *Lesnaya Ind.* No. 12, 1940 (43). [Russ.] [1842].

The hand lifting tongs described and figured consist of a wooden base plate carrying a steel link hinged at the bottom to the base and at the top to the lower arms of the tongs, curved in its upper part and provided with a ratchet to engage a pawl, also hinged to the lower arm of the tongs. The upper arm of the tongs is pivoted to the lower and the whole is attached to a jointed lever pole. In operation the base plate is stood near the log, the pole raised until the lower arm of the tongs passes under the log. On lowering the pole the upper arm closes on the log and both arms are locked in position by the pawl and ratchet. A further pull on the pole lifts the log. The implement will lift 0·5 metric tons between 50 and 70 cm. off the ground and is suitable for lifting logs on to sledges and other low vehicles.

32.96 : 32.91.2. SOSHNIKOV, M. N. Ratsionalizirovannaya vȳvozka po traktorno-ledyanȳm dorogam. **[Rationalized extraction on iced tractor roads.]** *Lesnaya Ind.* No. 12, 1940 (29–33). [Russ.] [1843].

The successful transport of logs during the autumn–winter period from log dumps to timber depots depends chiefly on the condition of the ice roads and the upkeep of the road and vehicles used for transport. For ice roads timely cutting and freezing of the track, regular watering, and clearance of snow and debris, are essential. The rate of transport depends on the rate of loading and unloading of logs. Rational methods may double or treble the output. A method is described and illustrated of loading tractor sledges by rolling logs up a simple log ramp with the aid of a type of a pike pole easily made at any smithy. The gradient of the ramp should be as small as possible, and it should be placed in such a way that logs can be rolled right up to their destined position. Ramps should be light enough to be moved about by one man. A second loading method involves the use of a platform from which logs skidded from felled areas are rolled off direct on to tractor sledges. The platform is laid on trestles and is 82 m. long, 1·5–2 m. high and 5 m. wide. For each metre of length 0·9 cu.m. of timber was used. Tractor sledges line up alongside the platform and 1 m. from its edge. The work is done by a crew consisting of 4 men, 2 on the platform and 2 below, all using pike poles to control the logs as they roll down. With this method a crew is capable of an average output of 70 solid cu.m. per man per 8-hour period. The idle period for horses skidding logs to the platform is considerably reduced. With this method detailed sorting of logs at initial log dumps is also possible.

Where loading is mechanized, the logs should be bundled and loaded by tractor on to the tractor sledges.

32.96 : 32.91.22 : 07.7. KERBITSKI, S. V. Uskorenie oborachivaemosti avtomobiley. **[Improving the trip time of timber lorries.]** *Lesnaya Ind.* No 12, 1940 (33–5). [Russ.] [1844].

As many as 30,679 lorry hours and 9,110 derrick hours (while waiting for the lorries) may be lost per year during the process of loading and unloading timber. Two methods, whereby convoy lorries and derricks would work independently of each other, to speed up transport are:—(1) *A loading machine* in which the drive is transmitted from lorry wheels, by means of friction drums, to a winch and a pair of jacks, mounted on a frame base to which the arm of a derrick is attached. The jacks support a forward log bunk with vertical retaining arms and behind this a 'semi-trailer' attachment is fixed. A lorry, kept specially for loading, backs on to the frame so that its rear wheels will operate the friction drums actuating the winch of the derrick for loading the bunk and semi-trailer which are held in position until a convoy lorry arrives to pick up the load. By this means the derrick will lift loads of up to 2 solid cu.m. at 1 m. per sec. After completing its job, the special lorry is driven off together with the loaders, to the nearest similar loading machine, goes through the same process, and thus continues to load with each machine in turn. A timber convoy lorry, on its arrival at the loading site, unhooks the empty semi-trailer plus bunk, backs against the friction drums under the loaded bunk supported by the jacks, and operates the latter so as to lower the load gently. The shaft of the loaded semi-trailer is then hooked to the lorry, which is driven off to the depot. At the depot a similar machine is used for freeing the loaded semi-trailer from the lorry, which picks up an empty semi-trailer and forward bunk and returns to the loading site.

(2) *Rolling container*, which consist of 2 log bunks with vertical, hinged retaining arms, mounted separately on flanged wheels. A portable narrow-gauge track is laid parallel to the lorry at the loading site. A loading machine similar to that described above is situated on the lorry road. Empty containers on the narrow-gauge track are rolled forward for loading when needed. A container when loaded is shunted behind the arriving lorry, which deposits an empty container on the side rails and pulls the loaded container, via a ramp with rails to guide the container, on to the deck, where similar rails receive it. The ramp is 6–8 m. long and as high as the back of the lorry (0·9–1 m.). On arrival at depot, the lorry releases the container, which rolls off directly on to rails leading to the unloading-and-sorting site, picks up an empty container and returns to the loading site at once.

33. CONVERSION AND PRESERVATION OF WOOD

33. **Wood utilization techniques (new). Notes for a report to the Forestry Panel of United Nations Interim Commission on Food and Agriculture.** United Nations Interim Commission on Food and Agriculture: Subcom. on Forestry, Misc. 16, 1944. pp. 80. [U.S. Forest Products Laboratory and Univ. of Wisconsin.] [1845].

This report was prepared by the U.S. Forests Products Laboratory at Madison. It reviews new mechanical and chemical wood-utilization processes in the light of their post-war significance, and was intended to serve as a basis for comments and additions by Forest Products Laboratories, government agencies and experts in various countries. Each process is dealt with under the headings: description of process; unit cost of process; investment and cost for standard unit; quantitative significance and post-war prospects; estimated effects on competing markets; estimated effects on investment and employment; estimated effects on forest drain and management.

33 (47.1). ROSCHIER, H. L'évolution récente des industries du bois en Finlande. [**Recent developments in the wood-utilizing industries in Finland.**] *Rev. int. du Bois* 13, 1946 (22–3). [F.] [1846].

Amongst recent developments in Finland are the manufacture of prefabricated houses, wallboard, Kraft paper and cellulose for rayon. The manufacture of alcohol from sulphite waste liquor already has a capacity of 50 million litres a year. The alcohol is mixed with imported petrol and makes an excellent fuel for internal combustion engines; it is also used as the basis of synthetic rubber and glycol. Lignosulphuric acid is also recovered from sulphite pulp manufacture, and is exported in considerable quantities. A by-product of soda pulp manufacture is a black liquid oil which is much used in the manufacture of soap, and from which lubricants and resin have been obtained. It is probable that there will still be a market for Pine oil after the war, and that production will rise to 65,000 metric tons a year.

Another byproduct of soda pulp manufacture is turpentine, which is regularly recovered in all factories at a rate of about 9 kg. per metric ton of pulp, which corresponds to a total maximum production of 5,500 metric tons per annum. A young Finnish scientist has developed a new method of wood saccharification and a factory for the exploitation of the process will shortly be built.

The manufacture of charcoal has greatly increased during the war. Tar is recovered from the pyrolysis of softwoods, and new factories now under construction will have facilities for the recovery of acetic acid and methanol from the pyrolysis of hardwoods.

33 (73) : 07.2 : 34.6. UHL, H. G. **The forest industries blaze new trails.** *J. For.* 43, 1945 (710–2). [Timber Engineering Company, Washington, D.C.] [1847].

The President of the Timber Engineering Company outlines the objectives of the company in the field of research, with special reference to its recently established wood products development shop and wood chemistry laboratory. It is not primarily concerned with fundamental or pure research, but with the commercial application of the results of fundamental research done elsewhere.

33 : 01.2 (71.4). MCELHANNEY, T. A., and PICOURT, R. Vocabulaire en usage dans les industries du bois. [**Vocabulary in use in the timber industry.**] Ministère des Terres et Forêts, Quebec. 1945. pp. 59. [F.] [1848].

This publication, which consists mainly of extracts from a book *Canadian Woods, their Properties and Uses* [cf. *For. Abstr.* 2 (260)] contains: (1) an English–French vocabulary in use in the timber industry, (2) abbreviations of terms in use in the timber industry, (3) explanations and equivalents in French of English terms and definitions, (4) a French–English glossary of some of the principal terms used to designate different parts of a motor engine.

33.1. *Mechanical Conversion excluding the Manufacture of Mechanical Pulp*

33.1 (71.4). LEGENDRE, J. R. A. Les industries du Québec utilisant le bois. [**The wood-using industries of Quebec.**] Ministère des Terres et Forêts, Québec. 1945. pp. 30. [F.] [1849].

This pamphlet is an extract from a book in preparation by the author. It gives an account of the organization of various processes, the tools used, dimensions and species of timber, size of the industry, etc. The industries dealt with are (1) manufacture of sashes, windows, etc., (2) furniture, (3) boxes, cases, etc., (4) handles, bobbins and various articles of turnery, (5) wood preservation, (6) parquet flooring, (7) lasts and shoe-trees, (8) cooperage, (9) coffins and biers, (10) miscellaneous industries.

33.12. Joinery, Turnery

33.12 : 07.7. HAYCOCK, A. H. **Mortising machines.** *Wood* 10, 1945 (314–7). [1850].

A description of the hand-lever mortising machine or 'chopper' and its operation. Being relatively inexpensive and not requiring any power, it is very useful to small builders and others who do a moderate amount of woodworking.

33.12 : 07.7. HAYCOCK, A. H. **Chain mortising.** *Wood* 11, 1946 (24–7, 54–6). [1851].

A description of the chain and hollow-chisel mortising machine, which has largely superseded the reciprocating-chisel type of machine; its operation, maintenance and repair.

33.12 : 07.7. **The Linderman automatic wood-fabricating process.** Muskegon Machine Co., Newburgh, N.Y. 1945. pp. 7. P.R. [1852].

Cf. *For. Abstr.* 7 (No. 1263).

33.12 : 33.15.2. **British Standard specification for flush wood doors (with plywood faces).** *Brit. Stand.* No. 459, Pt. 2, 1945. pp. 10. [1853].

An illustrated specification covering design; suitable timbers and plywood by species; defects to be excluded; construction; locks, letterplates; postal knockers and hinges; adhesives; weather mouldings; water bar; priming; finish; marking; protection during transit. An appendix specifies the recommended method of glazing.

33.14. Match Manufacture

33.14 : 12.26–8 : 23 : 24 : 32.81 : 31.42.1. Aspen som tändsticksvirke. [**Aspen as a match timber.**] *Svenska SkogsvFören. Tidskr.* 43, 1945 (479–87). [Sw.] [1854].

Owing to the stopping of imports from the Baltic countries, home-grown timbers have assumed greater importance in Sweden for match manufacture. Trials of × *Populus robusta* are in progress and this tree is already showing promise in southern and central Sweden. Aspen is well worth attention on suitable sites if given proper care, and the market for the timber is regarded as assured. Old neglected stands can be regenerated from root suckers. Grazing must be excluded and selection of the best stems made during cleanings and thinnings. Pruning may be worth while or an admixture of Spruce should be provided to assist natural pruning, and it is important to thin in time to secure good crown growth. A table of revised scaling and grading regulations for match logs of Aspen, Alder and Birch, is included. It is emphasized that internal fungus damage may not spoil a log for match veneer, hence infected logs may find a sale, and in view of this, infected butts should not be trimmed off and wasted. Careful felling is necessary to avoid splits. To avoid storage defects, timber must be delivered by May 15 at the latest. [Cf. *For. Abstr.* 7 (Nos. 1781, 2108).]

33.15. Manufacture and Use of Veneers and Laminated Wood. Improved Woods. Laminated Materials other than Wood. Glues and Gluing

33.15 : 01.6. **List of publications on glue and plywood.** *Mimeo U.S. For. Prod. Lab., Madison.* No. *R*513, 1945. pp. 13. P.R. [1855].

A revised list of publications giving the results of research on the development of waterproof glues, the preparation and application of glues and on various plywood manufacturing problems.

33.15 (43.1–5). **Visits to targets connected with the German plywood industry.** British Intelligence Objectives Sub-committee *Final Report* No. 4, Item 22, 1945 (1–33). P.R. [1856].

Fourteen reports by representatives of the British Intelligence Objectives Sub-committee made in July and August, 1945, on factories in Hanau, Grossostheim, Wiesbaden, Munich, Berchtesgaden, Mannheim, Darmstadt, and Stuttgart occupied in the manufacture of plywood, match splints, phenolic glues and other wood adhesives, resin-impregnated wood, coal-dust briquettes, furniture, and plywood machinery. The reports describe equipment, processes, composition of glues, etc., and products. Several of the factories are damaged by bombing.

33.15 : 33.8. **Plastic sandwiches.** *Sci. Amer.* 1945 (155–6, 158). D.S.I.R. [1857].

Experiments were carried out by engineers of the Air Technical Service of America to find a low-density, synthetic core with adequate strength, low moisture absorption and dimensional stability for sandwich fuselage for aircraft. Various combinations were subjected to compressive and tension tests, also tests to determine relative flexural rigidity, ultimate strength and bending tests. In the case of wood and plywood sandwich there were no failures but buckling was visible in some cases, and there was also no failure in glass-cloth laminate with a wooden core.

33.15.1. *Manufacture of Veneers and Laminated Wood*

33.15.1 (71.4). Collin, M. Les bois de placage du Québec. [**Veneer woods of Quebec.**] Ministère des Terres et Forêts, Québec. 1945. pp. 5. [F.] [1858].

The species most used for veneer-cutting in Quebec are Birch, Maple, Cherry, Elm, and Ash. The pamphlet gives a brief account of the process of manufacture of veneers and plywood.

33.15.1 (83) : 98.1. Slifko, C. W. **Chile's plywood and veneer industry.** *Veneers and Plywood* 39 (12), 1945 (26, 28, 29). P.R. [1859].

Between 1937 and 1939 Chile imported about one million square feet of plywood annually. Domestic production in Chile is now 400,000 cu. ft. per annum. The wood used is indigenous and the manufacturing plants are near the source of the timber, thus reducing production costs. The bulk of the plywood is of 3-ply construction bonded with imported casein. Waterproof and synthetic-resin glues have not yet been introduced. Three-quarters of the annual production is home-consumed and the remaining quarter is exported, the principal destination being Argentina. Chile has ample forest resources, the heaviest timber stands being in the south-central region. In addition to plywood Chile now manufactures one million square feet of veneer annually.

33.15.1 : 38.2. Dubin, E. A. **Glued laminated arches with sawed laminations.** *Mech. Engng., N.Y.* 67, 1945 (813–9, 838). L.S. [1860].

Test samples were cut from a laminated beam of clear Douglas Fir with moisture content of 12 per cent. before gluing. Estimating the moisture content after gluing to be not more than 16·6 per cent., the physical properties of the glued specimens were:—

Proportional limit = 6,650 lb./sq. in.
Modulus of rupture = 9,940 lb./sq. in.
„ „ elasticity = 1,760,000 „ „

From these computed values the physical dimensions of the specimens, span, method of loading, stress and strain diagrams were drawn. As a result of the tests carried out it was found that well sawn laminations for glue faces of glued-laminated structural members will produce joints of neat appearance and adequate strength, if proper gluing and fabricating methods are used, and that machining of surfaces to be glued should be required only to obtain uniform thickness of each lamination or to remove any rough or torn grain. Data on glued joints from other sources are also reviewed in some detail.

33.15.1 : 33.15.5. Hall, H. W. **Laminating adhesive.** *U.S. Patent* No. 2,370,033, Feb. 20, 1945. Chem. Abstr. 39, 1945 (3696). P.R. [1861].

Wood plies, bonded with a mixture of one part casein to 1·8 parts water, and allowed to dry, are soaked in a solution of urea and formaldehyde, and then pressed at 3,000–4,000 lb. per sq. in. at a temperature of 300–350° F. to produce a laminated wood article of extreme surface hardness.

33.15.1 : 31.8. Stevens, W. C., and Turner, N. **Investigations into the causes leading to the twisting of laminated bends.** *Sci. tech. Mem. Minist. Aircraft Prod.* No. 20/45 FP 27 RIS 32, 1945. pp. 13 + tbls. + plates. [Forest Products Research Laboratory, Princes Risborough.] P.R. [1862].

The material used in these investigations was slice-cut laminated Sitka Spruce of aircraft quality bonded with urea-formaldehyde glue. Descriptions of the individual tests and results obtained are given in detail. The tests so far carried out show that the main cause of twisting is the crossing of the grain of one or more of the laminae. Slice-cut laminae are always liable to twist, but, if such laminae are assembled with the grain parallel throughout, the danger of twist after gluing is little greater than for sawn material.

33.15.1 : 33.15.2. [Scroggs, A.] **The universal material. Plywood: its manufacture and purposes.** *Timb. Tr. J.* 175, 1945 (261–4). [1863].

This address, given under the auspices of the Design and Industries Association, reviews the developments in the manufacture and utilization of plywood during the war. Amongst the subjects dealt with are cellular construction, synthetic resin glues, metal-faced plywood, aircraft construction, compressed, impregnated veneers, resin surfaces, and British species suitable for the production of veneers.

33.15.2. *Use of Plywood and other Laminated Wood*

33.15.2. Hiscocks, H. E. **Plywood structures.** *Timber of Canada* 6 (3), 1945 (49–51, 55). [National Research Council.] [1864].

An abstract of an address dealing with recent developments in the manufacture of plywoods and their use as an engineering material, and proposing a great extension of their use in building.

33.15.2 : 31.27. Silberstein, J. P. O., and Smith, R. C. T. **Three-ply panels in end compression at 45° to the direction of the grain.** *Rep. Div. Aeronautics Coun. sci. industr. Res. Aust.* S.M. 42, 1944. pp. 18 + figs. + plates. P.R. [1865].

Results of tests on $\frac{3}{16}$ in.-thick flat Hoop Pine plywood panels, together with a theoretical investigation of an infinite strip loaded in this manner, which is useful in the interpretation of the test results. Design curves are given for the buckling coefficient for various ratios of sides and for the average stress corresponding to edge stresses up to about $6\frac{1}{2}$ times the buckling stress. *Authors' summary.*

33,15.2 : 31.27. Dale, F. A., and Smith, R. C. T. **Grid sandwich panels in compression.** *Rep. Div. Aeronautics Coun. sci. industr. Res. Aust.* S.M. 46, 1944. pp. 23 + tbls. + plates. P.R. [1866].

The strength of a form of construction, consisting of two skins of Hoop Pine (*Araucaria cunninghamii*) plywood separated and stabilized by a core consisting of strips of King William Pine (*Athrotaxis selaginoides*) to form a continuous grid, was examined theoretically and experimentally to determine its structural efficiency. A design procedure is given and the results show that reasonably high structural efficiency was obtained. Further work is necessary, however, before the ultimate loads can be predicted accurately.

33.15.2 : 33.8. Biot, M. A., and Jayne, J. M. **Horten tailless aircraft.** Combined Intelligence Objectives Sub-committee. Item 25, File No. xix–2, 1945. pp. 30. P.R. [1867].

A short description of a tailless jet-propelled fighter with plywood wing surface, built and designed by Horten Bros. Some data are also presented on a large transport flying wing, also of wood, now under construction.

33.15.2 : 33.8. Johnson, H. **Mammoth airplane: a plywood triumph.** *Veneers & Plyw.* 40 (2), 1946 (16, 18). P.R. [1868].

Details of the size and construction of the H-4 American flying boat. The wings were of laminated $\frac{1}{8}$-in. Birch veneer and the wing and fuselage coverings were of flat plywood $\frac{1}{48}$-in. thick, bonded with Tego. The gross weight of the flying boat is over 200 tons, the hull 200 ft. long and the wing spread 320 ft.

33.15.2 : 33.8. **Taking the curves with plywood.** *Mod. Plastics* 23, 1946 (112–3). P.R. [1869].

A brief description of the manufacture for American Army use of sled toboggans. Veneers of Birch or Hickory in varying plies are bonded with resin, hot-pressed and clamped between wood mould forms. The gee-poles are turned from solid billets of Hickory.

33.15.3. *Improved Woods*

33.15.3. Moore, G. E. **Improved wood.** Forest Products Laboratories of Canada, Dominion Forest Service. 1945. pp. 4. [1870].

The term 'improved wood' was originally used in connexion with wood products made by treating thin veneer with phenol-formaldehyde resins, assembling the veneers in parallel-grain arrangement, and subjecting the whole to high pressure and heat. More recently the meaning seems to have become less precise, and the name has been applied to wood treated with a variety of resins (phenolic, urea, melamine and vinyl) either in veneer form or as solid wood, and also to wood treated with no resins, but subjected to the action of heat and pressure alone, or to the action of gases.

In the development of the so-called improved woods, one of the main objectives has usually been to improve the dimensional stability of the wood, but it is pointed out that improvement in a particular sense may involve undesirable consequences with regard to other properties, e.g. impregnated, laminated, compressed wood picks up water only to the extent of about one-third as much as untreated wood, but toughness has been considerably diminished and the strength/weight ratios are generally lower than the ratios for untreated wood. Notes are given on the following products: Jicwood, Tegowood, Hydulignum, Compreg.

33.15.3. AUSTRALIA. **Council for Scientific and Industrial Research, Division of Forest Products: annual report for the year 1944–45.** Forest Products Laboratory, 69–77 Yarra Bank Road, South Melbourne. 1945. pp. 43. [1871].

Methylolurea, an initial condensation product of urea and formaldehyde, has been tested on a small scale as an impregnant for veneers in improved-wood manufacture and for solid timber, with satisfactory results. Improved wood so made has a higher moisture absorption and somewhat lower mechanical properties than improved wood made with phenol-formaldehyde resins; it is, however, colourless and will probably be preferred for decorative purposes where retention of the natural colour of the wood is desired (p. 34).

33.15.3 : 33.8 : 12.25. MATVEEV, V. G., and NYSENKO, N. T. Pogonyalki dlya tkatskikh stankov iz pressovannoy khvoynoy drevesiny. **[Shuttles for textile machines made of compressed coniferous wood.]** *Lesnaya Ind.* No. 12, 1940 (47–52). [Russ.] [1872].

The demand for Hornbeam for textile shuttles has been very great, as many as 6·16 million shuttles being used in a year, consuming 63,000 cu.m. of first-class timber. As available supplies of Hornbeam are not great and the wood is used by various other industries, tests were made with Pine and Spruce as substitutes. Compressed wood of these two species was found to be satisfactory, and standard light (350–450 g.) or heavy (460–600 g.) sizes of shuttles made from Spruce and Pine wood are recommended. The average service life of these shuttles was 1·5–2·5 times as long as those of Hornbeam and averaged 1,500 hours.

For this purpose butt logs should be used, and, if Pine is employed, it is necessary to select the wood with the least resin content, or to remove excess resin before compressing the wood. The cost of production of shuttles of Pine and Spruce is about the same as that for Hornbeam shuttles, but the longer service of the former would mean considerable economies in both timber and money. In spite of their satisfactory performance, shuttles made of Lignofol are not recommended, owing to the shortage of phenolic-aldehyde resin glues.

33.15.4. *Laminated Materials other than Wood*

33.15.4. WHITE, J. R. **Post formed laminates.** *Timber of Canada* 6 (3), 1945 (56–7, 61). [1873].

Post-formed fabric-base laminates are being used in large quantities, mainly in aircraft production. The process of post-forming is accomplished by heating the material rapidly to a point at which it has no inherent stiffness, subjecting it to deforming forces and then allowing it to cool. Phenolic-type laminates are best suited to the process, which is described in some detail in this address. Paper-base laminates are unsuitable for the purpose, owing to the shortness of the paper fibre.

33.15.5. *Glues and Gluing*

33.15.5. PINTO, E. H. **A brief history of wood adhesives.** *Wood* 11, 1946 (10–2). [1874].

The first of a series of articles on the development, varieties, and uses of modern adhesives. It is doubtful whether adhesives were used to any large extent in European woodwork from the fall of Rome until the beginning of the 16th century, when 'hot glues' came into general use. It was probably the introduction of inlay into furniture in the 16th, and veneer in the 17th century which aroused the need for and developed the use of a reliable wood adhesive. It is doubtful whether any 18th-century chairs have come down to us with their original glue-joints intact, but many of the early Victorian chairs show no evidence of having been re-glued, which seems to show that animal-glue joints, even when fully stressed, will last a hundred years.

33.15.5. MIELKE. **Report on phenol resin-adhesive P. 600.** British Intelligence Objectives Sub-committee *Report* No. Gp.2/HEC 3728, 1943. pp. 6. Translated at the Halstead Exploiting Centre, 1945. P.R. [1875].

An acid-hardening phenol resin manufactured in the Synthetic Plastics factory of Dynamit A.G. Troisdorf. This glue is mixed intimately with Troisdorf TW hardener. The best bonding temperature is about 20° C., at which temperature the glue is stable and usable for about 6 hours. Beech and Pine wood bonded with it were fully hardened after 12–15 hours. Results of tests for setting, jointing, resistance to water and boiling, duration, bonding of synthetic plastics and the bonding of impregnated or varnished woods are given some detail.

33.15.5. GOLICK, A. J., and DIKE, T. W. (to I. F. Laucks Inc.). **Bonding composition for plywood.** *U.S. Patent* No. 2,368,466, Jan. 30, 1945. Chem. Abstr. 39, 1945 (4530). P.R. [1876].

An aqueous formalin-NH_4OH solution having a pH of 10·5–12 is added to cresylic acid together with an emulsifying agent which is rendered insoluble when the adhesive bond is completed. The mixture is agitated until an emulsion of a potentially reactive, partially condensed cresol-CH_2O resin is formed having a pH of 8·5–10. To it is added an aqueous solution of blood and the mixture is agitated until an aqueous smooth fluid suspension of a thermo-setting resin-blood product is formed which is in finely subdivided state and has a pH of about 7·75–9·0. The whole process is carried out without application of heat.

33.15.5. AUSTRALIA. **Council for Scientific and Industrial Research, Division of Forest Products: annual report for the year 1944–45.** Forest Products Laboratory, 69–77 Yarra Bank Road, South Melbourne. 1945. pp. 43. [1877].

In order to conserve casein supplies, much experimental work was carried out on the development of substitutes for use as adhesives in plywood manufacture. It was shown that peanut flour, dried buttermilk, and milk-albumen blended with casein would each give satisfactory bonds for plywood.

33.15.5. CANADA. **Twenty-eighth annual report of the National Research Council of Canada, 1944–45.** National Research Council, Ottawa, Canada. 1945. pp. 40 + 43. [E.F.] *N.R.C.* No. 1342. [1878].

Development of adhesives and gluing materials in the production of laminated structures has engaged the attention of the colloids section. In this connexion, a new gluing method based on electric resistance heating was developed. This method is now being used commercially (p. 11).

33.15.5. KNIGHT, R. A. G., and DOMAN, L. S. **Long-term weathering tests on plywood glues.** *Wood* 10, 1945 (309–11). [1879].

This article brings up to date information on tests which were reported on in 1944 [see *For. Abstr.* 6 (175)]. Plywood of various species was prepared with a wide range of adhesives, the standard panel being 20 × 10 × $\frac{3}{16}$ in., and exposed under each of three selected conditions: (1) buried for half its length in the earth, (2) immersed in water to the same depth, (3) exposed to wind and weather on a wall facing south-west. The results are shown in a table. Taking all data into account, and bearing in mind the relatively short period of the test, it can be said that the phenolic resins are entirely reliable, the urea resins are of doubtful durability, and the extended ureas, casein, blood, and starch glues quite unsuitable for exterior work. A much more comprehensive series of weathering tests is now in progress at the Forest Products Research Laboratory at Princes Risborough.

33.15.5. BLACK, J. M., and BRUCE, H. D. **Durability of room-temperature-setting and intermediate-setting resin glues cured to different degrees in Yellow Birch plywood.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1537, 1945. pp. 4 + tables. P.R. [1880].

A progress report of findings to date in tests carried out to ascertain the minimum degree of cure which will provide satisfactory durability in Yellow Birch plywood joints. When original joint strength and wood failures were maintained, all the glues used showed little or no significant loss of joint quality during exposure and on this basis proved to be durable even at the lowest degree of cure tested. Intermediate-temperature-setting phenol glue, however, showed effects of acid damage to wood at high temperatures, and all glues showed some loss of joint strength at 158° F. at which temperature the wood seems to have deteriorated to some extent. Tables of results obtained are appended.

33.15.5. EICKNER, H. W. **Durability of papreg-to-papreg and papreg-to-Birch glued joints.** *Mimeo. U.S. For. Prod. Lab., Madison* No. 1538, 1945. pp. 6 + tables. P.R. [1881].

A study to determine the durability of well glued joints, when aged under controlled conditions of moisture and temperature. Joints between papreg surfaces and between papreg and Yellow Birch $\frac{1}{16}$-in. veneer were prepared with five types of glue and subjected to six exposure conditions. This report presents results of tests after periods of exposure up to one year. All glues produced well glued joints but there was some evidence that resorcinol-glued joints were somewhat undercured. Further studies are to be made.

33.15.5 : 33.15.2 : 38.2. HUNTER, P. R. **Building goals realised through plastics.** *Pacif. Plastics* 3 (10), 1945 (26–9). L.S. [1882].

Plastics are being combined with plywood in the form of overlays to diversify the application of plywood. Resin-impregnated fibrous sheets were applied to the faces of plywood during the war, for the manufacture of waterproof containers of great impact strength, and many interesting civilian uses now present themselves. Several different types of overlay with different possibilities of use are described.

The all-glued, wood-frame building is rapidly becoming a practical and economic possibility. The real construction problem lies in finding a technique for the field application of glue. With resorcinol adhesives, which set up at 70° F. and at contact pressures, wall boards could be bonded to studs and lightly nailed until the glue set. Double pointed nails might be used in the stud so that no nail holes would show in the face of the board. There has been perfected in southern California a light-weight, portable 110-volt short-wave diathermy apparatus for glue stitching. Urea or resorcinol glues may be used for brushing on to the structural studs; then a panel of plywood or plasterboard up to 1 in. thick, is held against the studs, the electrodes of the diathermy gun are placed against the face of the panel and the glue is polymerized or set up. The panel should be spotted at the bottom, top and middle of each stud, which holds it in place until the rest of the glue sets up in about 4 hours at contact pressure. This application offers great possibilities for applying expensive veneers or for making rapid installations where nail holes or hammer marks are not allowable.

33.15.5 : 33.15.3. AUSTRALIA. **Council for Scientific and Industrial Research, Division of Forest Products: annual report for the year 1944–45.** Forest Products Laboratory, 69–77 Yarra Bank Road, South Melbourne. 1945. pp. 43. [1883].

A large-scale experiment in the gluing of improved wood has been completed. Three acid catalysts were used, viz. toluene-sulphonic, sulphuric and hypophosphorous acids, and the base resins were modified by the addition of various amounts of resorcinol and novolak. After a 6-month accelerated ageing test, joint strengths of improved woods remained relatively unchanged, but those of control specimens made from Mountain Ash with all catalysts fell to 50 per cent. of their original values. High concentrations of resorcinol gave an increase of 20 per cent. in joint strength with improved wood, but high concentrations of novolak caused a marked decrease in strength. A further series of tests has been planned for the development of a cast phenolic-resin adhesive for the bonding of improved wood and other plastic-base materials at intermediate and room temperatures. Some preliminary service tests have indicated that a cast phenolic adhesive modified with resorcinol and using a high percentage of toluene-sulphonic acid is quite satisfactory for the cold-press gluing of improved wood (p. 34).

33.17. Sawmilling

33.17 : 07.7. FOYSTER, J. R. **The 'Foyster-Drabble' saw.** *Timb. Tr. J.* 175 (3607), 1945 (57–8). [1884].

An account, by the inventor, of the experiments which led to the development of his new saw [see *For. Abstr.* 7 (No. 1295)], which will be described more fully in his forthcoming book 'Modern Mechanical Saw Practice'.

33.17 : 33.52 (941). BEDNALL, B. H. **Sleeper sawmilling in Western Australia.** *Aust. For.* 9, 1945 (61–5). [1885].

Sleeper sawmills in Western Australia are mills which saw their logs to sleeper lengths in the bush. They were first developed in order to utilize economically inferior trees which could not be profitably hauled to the permanent mills. This innovation proved so successful that a number of mills was set up, operating in heavily cut-over bush. The layout of an efficient sleeper mill is shown in a diagram, and a description of its construction and operation briefly given. Such a mill would have a mill crew of 5 men and a bush crew (engaged in felling and hauling) of 8 men. This team would easily average 25 loads of sleepers (about 550 sleepers) per week. More sleepers are obtained by sawing sleeper lengths rather than a single long length.

33.17 : 33.7 (945). YOUL, J. W., and MOULDS, F. R. **Firewood utilisation in Victoria. Part II. Normal production practice and measures adopted for emergency mass**

production in wartime. *Aust. For.* 9, 1945 (33–40 + plates). [1886].

An earlier article [see *For. Abstr.* 6 (241)] dealt with the relationship of firewood production to forest management in Victoria. The present article discusses firewood production in normal times and the measures and methods used by the Forests Commission to deal with the scarcity of solid fuel in the Melbourne area after the beginning of the war with Japan. Three principal types of mobile sawbench were developed; a combined tractor and sawbench, a combined diesel engine and sawbench, and a combined electric motor and sawbench; these are described and efficiency and running costs are compared in some detail. The diesel engine was found to be a very economical plant to run.

33.3. *Chemical Treatment*

33.32. Pulp and Paper Manufacture. Wallboards. Plastics

33.32. Buebrech, W. L., Collier, D., and Boyce, C. **The world's paper and wood pulp industry before and after V.-E. Day.** *Industr. Ser. U.S. Dep. Comm.* No. 14, 1945. pp. 49. P.R. [1887].

The estimated world production of paper in the first year after V.-E. Day shows a deficit due to continued heavy military demands coupled with rising civilian consumption in many countries. In the second and third years after that date, European paper needs will substantially increase. World wood-pulp production in the first three years after V.-E. Day will approximately balance consumption needs with possible moderate surpluses. American and Canadian production will substantially increase and American consumption of paper will fall as the necessity for military uses diminishes. In the face of expected increased demand for wood pulp for the three years succeeding V.-E. Day, it is not expected that wood-pulp inventory replenishments will be large, and it will probably take several years to achieve a position in wood-pulp production sufficiently in excess of actual consumption to allow for substantial inventory replenishment. Estimates indicate that American post-war civilian consumption of paper will be about 5 million tons above pre-war figures. American wood-pulp consumption will also increase. Consumption needs in America will remain high and will be greatly influenced by rises or declines in the level of national economy. Facts and figures are given in detail with illustrative charts. The data are divided into two sections: Part I dealing with world production and consumption, and Part II with U.S. production and requirements of paper and wood pulp.

33.32 (44 : 43.1–5). Kress, O. **Some observations on the French and German paper industry.** *Paper Ind.* 27, 1945 (1207–9). P.R. [1888].

Before the war France used 443,500 tons of chemical and 352,600 tons of mechanical pulp annually, of which 468,000 tons was imported and the remainder was made in France. During the German Occupation this figure dropped substantially and has decreased still further since the liberation, mainly owing to lack of coal, transport and raw materials. The material used for pulp manufacture is Maritime Pine, similar in characteristics to Loblolly Pine but capable of storage for three years. Almost all the wood used has previously been turpentined. Some account is given of the machinery and equipment of the French and German industries. Brief mention is made of some of the more outstanding chemical investigations made in Germany during the war. The German pulp industry operates largely on Spruce and Beech. One of the projects most heavily financed by the German Government was the study of a hybrid Poplar which becomes an 8-in tree in 8–10 years. It has a cellulose content up to 50 per cent., and is particularly suitable for veneers, matches, pulps and other uses.

33.32 (71). **New peak in pulp and paper values.** *Pulp Paper Mag. Can.* 46, 1945 (841–6, 856). [1889].

The gross value of products of the Canadian pulp and paper industry reached a new record of $369,846,086 in 1944, an increase of 7·4 per cent. on the previous year. The volume of pulp and paper manufactured was very close to that of the previous year; pulp was about the same, and paper production increased by 2 per cent. Comparative statistics for the years 1943 and 1944 are given for wood-pulp production and export by kinds, and by provinces, exports of paper by kinds, chemicals used, imports of wood-pulp and paper by kinds.

33.32 : 33.33 (75.6). Randolph, E. E. **Suitability of North Carolina trees for chemical conversion products and for certain other**

uses. *Bull. N.C. Engng. Exp. Sta.* No. 26, 1943. pp. 48. P.R. [1890].

33.32 (81). **New Brazilian pulp and paper mill: industry's largest in South America.** *Pulp Paper Ind.* 19 (10), 1945 (17–21). P.O. [1891].

A new pulp and paper mill has been built during the war at Monte Alegre, Parana State, Brazil. The productive capacity is 40,000 tons bleached and unbleached sulphite pulp, 30,000 tons groundwood pulp and 48,000 tons newsprint annually. Parana Pine (*Araucaria brasiliensis*) will make the mill self-supporting. The groundwood pulp will be consumed at the mill but chemical pulp will be sold to other Brazilian paper manufacturers. General information on the Brazilian paper industry is also given. There are 41 paper producers in Brazil with an aggregate production in 1944 of 139,613 metric tons.

33.32 : 31.0 (91.1 : 921 : 922). Bahrfeldt, K., and Spoon, W. Onderzoek naar de geschiktheid van Nederlandsch-Indische houtsoorten voor de vervaardiging van papier. **[Investigation on the suitability of woody species of the Netherlands Indies for the manufacture of paper.]** *Ber. HandMus. kolon. Inst. Amst.* No. 188, 1943. pp. 31. [Du.du.] L.C. [1892].

The following coniferous and broadleaved species were investigated to ascertain their suitability for paper-making:—Conifers: *Agathis alba*, *Callitris calcarata*, *Cryptomeria japonica*, *Cunninghamia lanceolata*, *Cupressus lusitanica* var. *benthami*, *Pinus insularis*, *P. merkusii*, *Pinus* sp. (Taiwan akamatsu), *Podocarpus amara*, *P. imbricata* and *P. excelsa*. Hardwoods: *Acacia decurrens* var. *mollis*, *Anthocephalus cadamba* (= *A. indicus*), *Eucalyptus alba*, *E. globulus*, *Guazuma ulmifolia* var. *tomentosa*, *Hibiscus similis*, *Magnolia blumei* (= *Manglietia glauca*), *Shorea eximia*, two other *Shorea* species (Damar kelipik and Merkoejoeng), *Styrax benzoin*, *Trema orientale* and *Fagus sylvatica*. Data are given on certain factors (including fibre length and cellulose content) which affect the suitability of the woods for paper-making. The broadleaved species proved generally unsuitable on account of their short fibre length. Preliminary tests with conifers gave very satisfactory results for all species, but *Agathis alba*, *Pinus insularis*, *P. merkusii*, *Podocarpus amara* and *P. imbricata* showed greater promise than the remaining species on account of their longer fibres. These were further investigated under factory conditions. *Callitris calcarata* has the disadvantage that the paper made from it takes glue less readily because of an essential oil in the wood.

33.32 : 12.25 : 33.02 : 31 : 52 : 64. Klem, G. G., Løschbrandt, F., and Bade, O. Undersøkelser av granvirke i forbindelse med slipe- og sulfitkokeforsøk. **[Research on Spruce wood in connexion with groundwood and sulphite cooking experiments.]** *Medd. norske Skogforsøksv.* 9 (No 31), 1945 (1–127). [Nor.e.] [1893].

The material for this study was derived from even-aged Spruce stands on site qualities 2 and 3. Preliminary sampling showed that:—(i) for a given diameter, specific gravity increased and knot volume decreased with increasing height of tree; (ii) with increasing taper, specific gravity decreased and knot volume increased both for butt and top logs; (iii) for a given degree of taper, material from site quality 2 had lower specific gravity and higher knot volume than that from site quality 3; (iv) butt logs had rather fewer knots than top logs of the same taper class; (v) the lignin content of the butt up to about breast height exceeded that of the upper stem; (vi) lignin content increased with decreasing specific gravity; (vii) top logs had a higher percentage of extractables than butt logs; for site quality 3 the percentage of extractables decreased with increasing specific gravity; (viii) no significant correlation was found either between summerwood per cent. and specific gravity or between width of summerwood and position (vertical or horizontal) in the tree.

Groundwood tests: (i) For a given power consumption, pulp yield per cu.m. of wood decreased with increasing taper. (ii) In material from site quality 2 the tensile and bursting strength, drainage rate and Schopper-Riegler degree of beating decreased, whereas the bulk factor and chip percentage increased and tearing strength showed no significant variation, with increasing taper. Top logs gave pulp with better tensile and bursting strength, but denser than that from butt logs. (iii) Material from site quality 3 showed similar tendencies, but less clearly. Tearing strength, however, decreased significantly with increasing taper and was rather higher for pulp from top than for that from butt logs; in other respects pulp from top and butt logs was of roughly the same quality. (iv) The greater the taper, the more often the grindstone needed sharpening to maintain production and reduce power consumption, and the less uniform was the quality of the pulp.

Sulphite pulping tests: (i) No correlation was established between cooking time and wood properties. (ii) At the same degree of delignification, top logs from site quality 2 (but not from site quality 3) gave higher pulp yield per unit weight than did butt logs. (iii) Pulp yield per unit weight varied with Cl no. in practically the same manner for both site qualities; for site quality 3 the material was sufficient to show that significant differences in this relation occurred between individual samples, presumably owing to variations in the rate of lignin and hemicellulose removal. (iv) For both site qualities the pulp yield decreased with increasing lignin content and decreasing specific gravity. Yield was comparatively constant for taper up to 1 cm. per m., but then decreased with increasing taper. (v) Variation in yield per unit weight is attributable mainly to the relation between lignin and specific gravity, the variation in lignin content being the primary factor, though there were indications that yield also increased independently with increasing specific gravity. (vi) Yield per unit volume varied much more widely than that per unit weight. Wood of the lowest specific gravity and greatest taper yielded 176 kg. pulp per cu.m., whereas that of the highest specific gravity and least taper yielded 292 kg. (vii) Tensile, bursting, and folding strength of the pulp did not vary significantly with lignin content, specific gravity, taper, or breadth of annual rings. Beatability and tearing strength, however, decreased with increasing lignin content, taper and breadth of rings and with decreasing specific gravity. All strength properties increased somewhat with increasing beatability. (viii) Tensile and bursting strength were higher throughout for material from site quality 2 than from site quality 3. (ix) Beatability decreased with increasing lignin content and increased with increasing specific gravity of the wood. Tearing strength decreased with increasing lignin content and increased with increasing specific gravity and beatability. (x) Lignin content of the wood alone had no effect on beatability, and the correlation between beatability and lignin depends on that existing between lignin and specific gravity. (xi) If the influence of lignin and beatability was eliminated there was no correlation between tearing strength and specific gravity. The observed correlation depends (*a*) on that between specific gravity and lignin, and (*b*) on that between specific gravity and beatability. Further, independently of a correlation between lignin and beatability, tearing strength decreased with increasing lignin content and with decreasing beatability.

D.b.h. and height in relation to pulp yield: The correlations discussed in this paper suggest that pulp yields per unit volume may be materially increased by rational management of the forests [cf. *For. Abstr.* 5 (253)]. In this connexion it would be useful to have a means of expressing the mechanical and chemical pulp yields of stands side by side with the usual volume and increment calculations. Though the material is as yet insufficient, tentative tables and graphs are presented in which pulp yields are plotted against d.b.h. and height.

33.32 (43.1–5) : 12.25 : 12.26–8 : 34.24 : 33.39 : 34.6. HILL, A. C., and BOYD CAMPBELL, W. **Zellstofffabrik Waldhof, Mannheim Mill, Mannheim Waldhof.** British Intelligence Objectives Sub-committee *Final Report* No. 52, Item 22, 1945 (pp. 9 + table). L.S. [1894].

This mill was visited by representatives of BIOS to obtain detailed information of methods of manufacture of sulphite pulp from Spruce and to follow any new developments in pulp production and utilization of waste sulphite liquors. Beech was used during the war for the manufacture of chemical pulp and paper where strength was not of prime importance. All Spruce wood was used for the manufacture of pulp. Spruce with a density of 0·40 to 0·45, a moisture content of 30 per cent., and seasoned for six months is used. A detailed report of cooking practices for the principal grades of pulp is given. Torula food yeast for human consumption is made from the Beech waste liquor and absolute alcohol from the Spruce waste liquor when available. The waste liquor from the alcohol plant is concentrated and shipped for conversion to tanning extract. Methods of paper manufacture could not be evaluated as no operations of interest were being carried on. Specifications of No. 1 pulp from Spruce and Beech are appended.

33.32 : 12.26–8 : 34.36. **Colonial research 1944–45. I. Colonial Research Committee: Second Annual Report. II. Colonial Products Research Council. Second Annual**

Report. III. Colonial Social Science Research Council. First Annual Report. H.M. Stationery Office, London. *Cmd.* 6663, 1945. pp. 31. [1895].

Attention has been directed to the possibility of using Wallaba (*Eperua falcata*) wood, which is stated to grow in large stands in British Guiana, for the manufacture of paper pulp. Since this wood is rich in resin, it is desirable to examine this in order to determine whether it might be of economic value. If a use can be found for the resin, it would remove a serious obstacle to the establishment of a paper-pulp industry. The investigation has been recently undertaken at the University of Manchester (p. 21).

33.32 : 12.26–8. Australia. **Council for Scientific and Industrial Research, Division of Forest Products: annual report for the year 1944–45.** Forest Products Laboratory, 69–77 Yarra Bank Road, South Melbourne. 1945. pp. 43. [1896].

A study was made of pulp and paper from *Eucalyptus calophylla*. Samples were taken throughout the length and breadth of two trees, one comparatively free from gum veins, whereas the other, as is usual with this species, contained many gum veins. There was no difficulty in pulping the gum-free wood to secure a high yield of pulp (55 per cent.) at a low chemical cost. From the 'gummy' wood the pulp yields were much lower (45 per cent.), the chemical cost excessive, and the pulp difficult to bleach. From either tree the pulp was of the same quality, namely, inferior to the usual Eucalypt pulps in bursting and tensile strength, but superior in tearing resistance (p. 12).

33.32.1. *Pulp Manufacture*

33.32.1. Richter, G. A. (to Eastman Kodak Co.). **Refined wood pulp.** *U.S. Patent* No. 2,380,706, July 31, 1945. Chem. Abstr. 39, 1945 (5077). P.R. [1897].

Highly purified dried wood pulp (96 + per cent. α-cellulose) can be readily acetylated if it is reactivated before acetylation. The reactivation step involves treatment of the α-pulp with 1–3 per cent. Na_2SO_3 solution of pH 7·8–8·4, at 140–160° for about 2 hours at a consistency of 8–10 per cent. The cause of the reactivation is not known, although it is believed to depend, in part, on change in the character of the cellulose gel resulting from the action of the strong alkali used in refining the pulp. Other alkali or ammonium salts of weak acids, such as boric, acetic, or carbonic, may be used in place of Na_2SO_3. This reactivation is effective with kraft as well as with sulphite wood pulps. The reactivated α-pulps acetylate readily to yield films with colour and clarity at least equal to those obtained with high-grade cotton linters.

33.32.1. Campbell, W. G., and Packman, D. F. **Lignified material: isolation of cellulose.** *Brit. Patent* No. 572,728, July 7, Dec. 12, 1941; Oct. 22, 1945. Brit. Cotton Ind. Res. Ass. Summ. 26, 1945 (22). [Forest Products Research Laboratory, Princes Risborough]. P.R. [1898].

Material containing 17 per cent. or more of lignin is digested for cellulose by a process with the following features: (1) nitric acid of 2–7 per cent. concentration is used, (2) the material is always in contact with 12–22½ per cent. of its weight of acid (calculated as pure HNO_3), (3) the temperature is 90–100° C. and the time is between half an hour and 3 hours.

33.32.1 : 07.7. Curry, R. S. **Pulping machine.** *Brit. Patent* No. 572,895, Jan. 15, Feb. 11, Apr. 15, 1943; Oct. 29, 1945. Brit. Cotton Ind. Res. Ass. Summ. 26, 1945 (22). P.R. [1899].

A process for manufacturing pulp from wood and other raw materials, in which the material is continuously fed with water into a rotary disintegrating machine in which it is dashed against the walls with sufficient force to break up the material without damaging or unduly shortening the fibres. The material may be softened with hot water or caustic soda before disintegration, and cooked with caustic soda after the treatment. The process may be repeated. The pulp is finally screened and washed.

33.32.1 : 12.25. Keller, E. L., and McGovern, J. N. **Sulfite pulping of Western Red Cedar.** *Mimeo. U.S. For. Prod. Lab., Madison.* No. *R*1494, 1945. pp. 7 + tbls. P.R. [1900].

When Western Red Cedar (*Thuja plicata*) was subjected to sulphite pulping conditions previously found satisfactory for Western Hemlock, it proved to be difficult to pulp. Difficulties could be overcome to some extent by employing a cooking liquor high in calcium bisulphite, with a long cooking time, but only non-bleaching pulps could be obtained. Sodium and magnesium base liquors were more effective agents than calcium. High-magnesium-content bisulphite (28 per cent. in comparison with a normal content of 15 per cent. based on the wood) enabled bleachable pulp with a low yield of only 41 per cent. to be produced. The bleaching and non-bleaching pulps had strength properties in general equal to commercial unbleached sulphite pulp, but their dark colour would limit them to uses where colour is not a consideration. The bleachable Western Red Cedar pulp was readily bleached to a satisfactory brightness in a two-stage process using a total chlorine consumption of 5 per cent., and the bleached pulp was equal in strength properties to commercial bleached Western Hemlock pulp and might perhaps find similar outlets. The low density of the wood and low percentage yields of pulp indicated a yield of pulp per unbarked cord of only 660 pounds (oven dry basis) in comparison with average commercial yield for Spruce of about 920 pounds. *Authors' summary.*

33.32.1 : 31.1 : 31.8 : 12.26–8. AUSTRALIA. **Council for Scientific and Industrial Research, Division of Forest Products: annual report for the year 1944–45.** Forest Products Laboratory, 69–77 Yarra Bank Road, South Melbourne. 1945. pp. 43. [1901].

Investigations have been in progress on the fibres isolated from the brittle heart of *Eucalyptus regnans.* These fibres behave similarly to normal fibres from the same tree, except on treatment with acid, when the brittle-heart fibres fall into a number of pieces. An examination has been made of the structure of fibres from both normal and brittle-heart wood and having (*a*) a high percentage of lignin, (*b*) a high percentage of xylan and no lignin, (*c*) no lignin and no xylan. The holocellulose and kraft fibres, on swelling with sulphuric acid, behaved similarly, though the presence of the lignin in the kraft fibres restricted the swelling to some extent. The fibres from which both lignin and xylan had been removed by alkaline treatment swelled in a different manner. It appears that the caustic extraction has a weakening effect on the outer layer of the fibre, which it partly removes (pp. 7–8).

33.32.1 : 31.22.1. **The relationship of wood moisture and wood species to pulp and paper quality and paper machine efficiency.** Groundwood Committee, Canadian Pulp and Paper Association, Montreal. 1944. pp. 26. P.R. [1902].

White and Black Spruce, Balsam, and White Pine were tested to determine the effect of moisture content on grinding of pulpwood. Wood with a moisture content over 40 per cent. gave the best-quality pulp. Extremes of wood moisture content can be handled, provided wet and dry woods are not mixed, and the cooking acid and cooking cycle are adjusted accordingly. Higher pulp quality is obtained from separate grinding of different wood species, and, in chemical pulping, higher yields are obtained, with a saving of power and a reduction in chemical and steam consumption.

33.32.1 : 31.3. THOMAS, B. B. **The isolation and analysis of hemicellulose fractions from Aspen holocellulose.** *Paper Ind.* 27, 1945 (374–8, 382). L.S. [1903].

Holocellulose, prepared from Aspen by a method permitting the use of large samples, was fractionated with cold and hot water and 5- and 15-per-cent. potassium-hydroxide solutions into a total of seven fractions. Each fraction, including the final residue, was analysed for ash, nitrogen, acetyl, methoxyl, uronic acdis, xylan, and glucosan, the last being done by determining the loss in reducing power on fermentation with two different yeasts. Summative calculations of these results accounted for 94 per cent. of the holocellulose and 90–107 per cent. of the fractions, with the exception of the dark hot-water-soluble 'D,' as well as nearly all the more important constituents as distributed among the fractions. The observation previously made that holocellulose retains a small amount of lignin, apparently held in combination with monoethanolamine and not detectable by a lignin analysis, was studied in some detail and confirmed. This residue is removable with hot water, but only with the simultaneous loss of a considerable amount of hemicellulose. This method of approach to the study of hemicellulosic material permits the examination of an unbroken series of products from the most easily soluble polyuronic to the pure celulose and should prove useful for further research. *From author's summary.*

33.32.1 : 31.3 : 12.25. LOVELL, E. L. **Fibrous holocellulose from softwoods.** *Industr. Engng. Chem.* (*Industr. Ed.*), 37, 1945 (1034–7). P.R. [1904].

A method, using acidified sodium chlorite, is described for preparing relatively large batches of fibrous holocellulose from Western Hemlock (*Tsuga heterophylla*) and Slash Pine (*Pinus caribaea*). Determinations of alkali solubility show that the α-cellulose fraction forms the greater part of these celluloses; the remainder being entirely the γ-fraction. The average degree of polymerization found for both celluloses was between 1100 and 1600. Before drying, the Pine and Hemlock chlorite holocellulose fibres appeared round and straight under the microscope; when dried, they collapsed and twisted and, on re-wetting, did not regain their original appearance. Slash Pine chlorite-cellulose sheets showed a characteristically rapid drop in freeness on beating, and bursting strength, which was initially high, did not increase. [Cf. *For. Abstr.* 7 (No. 773).]

33.32.1 : 31.3. Katzen, R., Sawyer, F. G., and Othmer, D. F. **Extraction of lignin from hydrolyzed lignocellulose.** *Industr. Engng. Chem.* (*Industr. Ed.*) 37, 1945 (1218–22). P.R. [1905].

The solubility characteristics of lignin present in acid-hydrolysed lignocellulose were observed. Methanol was chosen as the most practical solvent for the separation and recovery of soluble lignin. Batch extraction experiments with methanol yielded lignin solutions of low concentration. The method of extraction, however, did not appreciably affect the nature of the lignin. Ninety-eight per cent. of the lignin extracted was recovered by concentrating the extract to 25 per cent. lignin content and precipitating in 3 parts of water per part of concentrate. Ternary equilibrium data were obtained for the system methanol—methanol-soluble—lignin-insoluble lignocellulose. Application of continuous counter-current extraction methods based on these data yielded extracts containing as much as 11 per cent. lignin. Higher concentrations were shown to be feasible by re-use of the extract on fresh lignocellulose feed. Calculations are presented, indicating a steam consumption of 2,500 lbs. for solvent recovery per 100 lbs. of lignin recovered. Actual methanol losses could not be determined in the apparatus used. *Authors' summary.*

33.32.1 : 31.42.1. Rennerfelt, E. **The development of the fungus flora in wet mechanical pulp, manufactured at different temperatures and stored under different conditions.** *Göteborg Högsk. Årskr.* 47 (22), 1941. pp. 47. [E.] P.R. [1906].

The primary composition of the fungus flora in wet mechanical pulp depends chiefly on the temperature in the circulating system. Below 40° C. *torulopsidei*, yeast-like fungi, dominate quantitatively, but they decrease with rise in temperature. Blueing fungi, moulds and wood-destroying fungi are similarly affected but probably to a lesser degree, since their spores are more resistant to high temperatures. All groups of fungi increase during the first months of storage, then the *torulopsidei* begin to decrease and die out to a great extent as the wood pulp dries. Blueing fungi and moulds are not so sensitive to decreased water content. The moulds develop mainly in laboratory-stored pulps, where they finally become the dominating group. Blueing fungi develop best in factory-stored pulp, possibly owing to the fact that the *torulopsidei* are present from the outset in lesser numbers. Fungi develop more rapidly in pulp which has been frozen during part of its storage than in that which has not been frozen.

33.32.3. *Wallboards, Fibreboards, etc.*

33.32.3. Vernerey. Charactéristiques et emplois des panneaux en fibre de bois. [**Properties and uses of fibreboards.**] *Rev. Eaux For.* 83, 1945 (105–9). [F.] [1907].

A general account of the manufacture, physical and mechanical properties, and uses of fibreboards.

33.32.3 : 34.6. Irsa, G. I. de, and Wood Impregnation Ltd. **Production of boards and sheets from waste fibrous materials.** *Brit. Patent* No. 571,280, Aug. 17, 1945. Brit. Abstr. BII, 1945 (375). P.R. [1908].

Boards, etc., are made by treating waste fibrous organic materials (such as sawdust, wood shavings, etc.), with a solution of a fireproofing salt (2 per cent. of NaF in a 5-per-cent. solution of $HgCl_2$ in milk of CaO (10 per cent.)), and then, under heat and pressure, with a silicifying compound (5- to 10-per-cent. solution of H_2SiF_6) to which may be added bitumen and cryolite to make the fibres water resistant. Drying, mixing with an organic binder (polymerized resin, montan wax or pitch, glue) and forming into boards under the action of heat and pressure, complete the process.

33.32.4. *Plastics*

33.32.4 : 33.15. Fleck, H. R. **Plastics: scientific and technological.** The English Universities Press Ltd. Little Paul's House, Warwick Square, London, E.C.4. 1945. pp. 361 + 42. Price 30*s*. P.R. [1909].

A comprehensive survey with chapters on the history, raw materials, theoretical principles of polymerization, chemistry, manufacture, synthetic elastomers or rubber-like plastics, physical properties of thermoplastic materials, physical properties of thermosetting materials, synthetic resins, fibres and textiles, adhesives, plywood and impregnated wood, manufacture of dies and moulds and of plastic articles, chemical analysis of raw materials, chemical, physical and electrical testing of plastics, appendices and index. The book is illustrated.

33.32.4 : 33.15. **Latin American plastics industries need U.S. materials and equipment, survey shows.** *Pacif. Plastics* 3 (10), 1945 (15–21). L.S. [1910].

Argentina has the largest plastics moulding industry in Latin America. The Camara de Moldeadores de Materiales Plasticos with its twenty-six subsidiary companies accounts for 85 per cent. of the total moulding production. Shortage of imported formaldehyde has hindered production during the war. Opinions differ as to the suitability of Argentine timbers for plywood. Several firms, however, are producing it, using natural resins. Argentina has a paper industry producing low-grade newsprint and wrapping paper from Argentine Poplar, which is widely grown for shelterbelts, regenerates naturally, and grows fast. There are, at present, no paper laminating or coating industries in Argentina. Chile makes moulded articles and has a growing paint industry using imported resins. Columbia has a growing plastics industry and an industry is developing in Mexico to produce large sheets of plastics using Co-ro-lite (fibre-filled phenolic) and other laminates. Mexico, rich in timber, has a growing plywood and veneer industry, producing one hundred million square feet per year. Cuba, Uruguay, Venezuela and Peru have small but growing plastics industries.

33.32.4. Blake, S. W. **Cellulosic materials and the plastics industry.** *Pulp Paper Mag. Can.* 46, 1945 (925–7). [1911].

A brief review of the latest developments in the use of wood, wood-pulp and paper for the manufacture of plastics. The subjects dealt with are plasticized wood, plasticized sawdust, chemically transmuted wood, ligno-cellulose plastics, hardboard, compressed wood, plywood, laminated paper plastic, moulded pulp, impregnated board, plastic-coated paper, wet strength paper, alpha pulp, wood flour.

33.32.4. Leaper, P. J. **I.G. Farbenindustrie, Wolfen Farbenfabrik, Wolfen near Halle.** Combined Intelligence Objectives Sub-committee. Item 22, File No. xxv–19, 1945. pp. 9. P.R. [1912].

Among the many war products manufactured at the I.G. Farbenindustrie, Wolfen Farbenfabrik, Wolfen, near Halle, which was visited by representatives of CIOS on 26th June, 1945, were a number of synthetic resins, one of which was a substitute for bakelite. It was made at the rate of 10 tons per month and in it phenol was replaced by lignin for the condensation with formaldehyde. Ionic exchange resins were made by condensation of formaldehyde with phenol or resorcinol, which were claimed to have excellent sodium-ion-absorbing properties. Other good exchange resins were produced when benzaldehyde replaced formaldehyde. All these exchange resins were sold under the name of 'Wolfatit'.

33.32.4. Bailey, A. J., and Ward, O. W. **Synthetic lignin resin and plastic.** *Industr. Engng. Chem.* (*Industr. Ed.*) 37, 1945 (1199–202). P.R. [1913].

The condensation of lignin preparations with various condensing agents and catalysts has been studied. The most successful reaction found is the condensation of butanol lignin with formaldehyde to produce a thermosetting resin. When the resin is properly compounded with plasticizer and filler, it produces a plastic with flexural strength, modulus of elasticity and impact strength, in either wet or dry condition, equal to those of plastics now in industrial use. Details for preparing the plastics are given, together with comparative quantitative data of flexural and impact strengths, modulus of elasticity, and water absorption of the lignin plastic and commercial plastics. *Authors' summary.*

33.32.4. Gleason, C. R., and Small, R. M. (to Sealkote Corp.). **Synthetic resin-wood-pulp molding composition.** *U.S. Patent* No. 2,365,753, Dec. 26, 1944. Chem. Abstr. 39, 1945 (4524). P.R. [1914].

Wood pulp is treated in a heater and when the fibres are opened up, the H_2O is adjusted to H_2O 2 : pulp weight 1. This pulp is transferred to a steam-jacketed mixer provided with a vacuum head. The pulp is stirred, the temperature is brought up to 200° F., and a phenol-CH_2O or other suitable resin is mixed in. The temperature of the resin is preferably about 200° F. The resin may be prepared at the same time as the pulp and when ready both are mixed as outlined. When the pulp and the resin are mixed a plasticizer, e.g ethylene glycol, a lubricant, e.g. stearic acid, and a curing agent, e.g. $(CH_2)_6N_4$ are added. The mixture is gradually dehydrated and ground to the desired size.

33.32.4. TINSLEY, J. S. (to Hercules Powder Co.). **Molding composition.** *U.S. Patent* No. 2,368,788, Feb. 6, 1945. Chem. Abstr. 39, 1945 (5,562). P.R. [1915].

An inexpensive plastic moulding composition, which has improved flow characteristics and lower moulding temperatures, is prepared from a mixture of cellulose acetate, plasticizer and a Pinewood resin insoluble in a petroleum hydrocarbon. A typical composition comprises 60 parts of cellulose acetate, 20 parts of methyl phthalyl ethyl glycolate and 20 parts of Pinewood resin insoluble in a petroleum hydrocarbon.

33.32.4 : 31.3. ENGLERT, R. D., and FRIEDMAN, L. **Testing of plastics from Scholler lignin.** *Pacif. Plastics* 3 (10), 1945 (38, 40). L.S. [1916].

When Scholler lignin was brominated in carbon tetrachloride and treated with ammonia under pressure a product containing 8 per cent. nitrogen was obtained, which would react readily to formaldehyde. Moulded test bars of this material were not, however, satisfactory and further experiments are urged. Scholler lignin, tested at room temperature, proved to be only slightly soluble in all common laboratory reagents. A comparative table of solvents used is given. The low solubility and results of tests to ascertain chemical groupings indicate that Scholler lignin is very different from native lignin in the wood. Moulding experiments with Scholler lignin mixed with wood flour, phenolic resin and other materials, show that, without some chemical modification, it does not lend itself to use in moulding powders. Tabulated results of experiments to modify Scholler lignin chemically show that breakage occurred in almost every case during removal from the mould.

33.36. Preservation of Wood. Seasoning and Drying

33.36 : 11.15. AUSTRALIA. **Council for Scientific and Industrial Research, Division of Forest Products: annual report for the year 1944–45.** Forest Products Laboratory, 69–77 Yarra Bank Road, South Melbourne. 1945. pp. 43. [1917].

At the request of the R.A.A.F., a series of tests was initiated to compare infra-red reflectance of various aircraft finishes, the object being to reduce the temperatures attained by aircraft exposed to solar radiation. Preliminary tests indicate that substantial benefits can be obtained by the use of special infra-red-reflecting ingredients, at the same time retaining the desired colour scheme (p. 17).

33.36 : 33.52. AUSTRALIA. **Council for Scientific and Industrial Research, Division of Forest Products: annual report for the year 1944–45.** Forest Products Laboratory, 69–77 Yarra Bank Road, South Melbourne. 1945. pp. 43. [1918].

Inspection of test sleepers of *Pinus radiata* in South Australia indicated the value of mixing crude oil with creosote for preservative treatment. The effect of the oil is to reduce moisture change and, therefore, cracking of the sleepers (p. 27).

Work has been undertaken on the use of less durable timbers for railway sleepers. Two possible methods of treatment are being investigated, (*a*) diffusion treatment of green timber, (*b*) high-pressure treatments. Promising results have been obtained at pressures of 1,000 lb./sq. in. on certain Eucalypt timbers which are untreatable at normal pressures of 150–200 lb./sq. in. Using low temperatures with no initial vacuum, no visible damage has been caused, and the practicability of the method is being investigated (pp. 28–9).

33.36.1. *Preservation against Attack by Plants and Animals*

33.36.1. BAVENDAMM, W. Fortschritte der Holzschutzforschung. [**Advances in research on the preservation of wood.**] *Abstr. in Forstwiss. Cbl. u. Thar. forstl. Jb.* No. 1, 1944 (47–9). [G.] [1919].

33.36.1. ALLIOT, H. Méthode d'essais des produits anticryptogamiques. [**Method of assay of anticryptogamic products.**] *Bull. tech. Direc. Eaux For., Paris, et Inst. nat. Bois* No. 1, 1945. pp. 27. [F.] P.R. [1920].

Standard methods for the assay of wood preservatives, used at the Central Laboratory of Wood Testing, France.

The normal nutritive medium (formula given) is a modification of that of Lutz and differs from the standard used in British and German laboratories. The test fungi are *Coriolus versicolor*, *Gyrophana lacrymans*, *Xanthochrous pini*, *Lenzites quercina* and *Lentinus degener*. The methods for determining the sterilizing and the toxic powers of a preservative comprise 2 series of tests on the nutritive medium, the first of which gives the dysgenetic threshold, i.e. the weakest concentration of preservative that prevents development of the fungus, and the second gives the concentration and time needed to kill the fungus. These tests yield comparative data on the action of preservatives of analogous chemical composition (e.g. saline solutions, or phenol derivatives), but they do not give a definite conclusion by themselves.

Methods for tests on wood are designed to study the attack on leached and non-leached impregnated samples and to measure the efficiency of the product as a protective agent and compare the action of the fungus in treated and untreated wood; leaching gives information on fixation and its durability. Copper sulphate and creosote are the standards for comparison. Details are given of the technique of impregnation of test pieces, drying, weighing, rehumidification, exposure and culture for 4 months; the results are expressed in loss of weight after drying at 105° C. The leaching technique is based on the Soxhlet principle but the water vapour is condensed above the refrigerator before falling on the wood, and an automatic alarum indicates each siphoning cycle.

Methods of testing wood treated under industrial conditions cover specifications for sample cross sections of telegraph poles and sleepers and the location of test pieces therein.

33.36.1. Lutz, L. La méthode 'wood-block' pour la détermination du pouvoir toxique des antiseptiques utilisés pour la préservation des bois d'oeuvre. Ses incertitudes. [**The 'wood-block' method of determining the toxicity of antiseptics used to preserve timber: its uncertainties.**] *Rev. int. du Bois* 13, 1946 (1–2). [F.] [L'École Superieure du Bois, Paris.] [1921].

The writer criticizes the German 'wood-block' method of infecting specimen blocks of wood with fungi and then testing the toxicity of preservatives by impregnating the blocks. The two principal weaknesses of the method are (1) that it measures only the toxicity and not the inhibitory power of the preservative, and (2) that it is practically impossible to impregnate a piece of wood with an insoluble substance.

33.36.1. Wood, G. (to Wood Treating Chemicals Co.). **Wood impregnation.** *U.S. Patent* No. 2,382,374, Aug. 14, 1945. Chem. Abstr. 39, 1945 (4739–40). P.R. [1922].

To control the quantities used in deep impregnation with solutions in light solvent, the excess is expelled by later heating. The preservatives are represented by creosote, phenols, etc., in furnace oil, fuel oil, etc. Thus, lumber is loaded on cars and run into a retort which is filled at room temperature with a light fuel oil containing 5 per cent. of pentachlorophenol. The pressure is raised to 200 lb. per sq. in. until the desired degree of gross impregnation is obtained as measured by the volume forced into the retort. The pressure is vented and the temperature raised by steam coils in the solution. The cold solution may be drained and a preheated solution used for filling. The temperature depends on character of wood, seasoning and size of timbers. With well seasoned Yellow Pine 2 × 4's a maximum of 175–200° F. for 1 hour is used. The higher the temperature the less the retention. Green Yellow Pine 2 × 4's steamed or boiled in oil may cool before impregnation, in which case 150–175° F. suffices, but, if still hot when the cold preservative is run in, require 175–200° F. Larger timbers require longer heating. The final temperature must be below that which produces excessive amounts of gas such as to split the wood or disrupt the cell structure. When recovery is sufficient the hot preservative solution is discharged. By this process the gross impregnation of dry Southern Pine sapwood lumber was 3 gallons per cu. ft. with 2 gallons recovery leaving 1 gallon evenly distributed throughout the treatable area.

33.36.1. Hartley, C. **Lumber shipped green can be protected against decay.** *For. Pathol. spec. Release U.S. Dep. Agric.* No. 26, 1945. pp. 3. P.R. [1923].

Green timber can be successfully treated against sap stain, mould and decay at a cost of about 15 cents per thousand board feet. Lignasan, Dowicide, Permatox and mixed chemicals have all been tested and found satisfactory. Treatment should be carried out within 24 hours of sawing. Dipping is only partially effective on timber from old logs in which infection has already started; it must not be confused with the more permanent preservation obtained by impregnation, nor will it warrant the use of green timber when dry timber can be obtained.

33.36.1. KROGH, P. M. D. **Pentachlorophenol solutions for the preservation of wood.** *Fmg. S. Afr.* 20, 1945 (761–9). D.S.I.R. [1924].

The properties of pentachlorophenol, and experiments in pentachlorophenol treatment of wood both in South Africa and the United States of America are surveyed and the response of various South-African-grown softwoods to such treatment is compared with that to other treatments. The relative amenity of the different species in order of tangential penetration is also given. Costs of treatment, fire hazard, gluing possibilities, preservative painting of such treated timber and toxicity to human beings of pentachlorophenol are discussed.

33.36.1 (4). RISCHEN, H. W. L. Aperçu des antiseptiques pour la préservation des bois utilisés dans les différents pays européens avant et pendant la guerre. [**Review of wood preservatives used in different European countries before and during the war.**] *Rev. int. du Bois* 13, 1946 (3–8). [F.] [1925].

The extensive use of creosote for war purposes has necessitated the substitution of other substances for preserving railway sleepers, telegraph poles and power-transmission poles. The International Office for the study of Wood Preservation sent out a questionnaire to railway companies, postal authorities and other consumers of creosote in different countries, in order to obtain information on the changes which had taken place in wood preservation as a result of the war. A summary of replies is given from 14 countries: Germany, Belgium, Bulgaria, Croatia, Denmark, Spain, Hungary, Italy, Norway, Netherlands, Portugal, Rumania, Sweden, Switzerland. No really effective substitute for creosote has been discovered. The substitutes generally used were Tanalith U, Tanalith K, and Basalit UA.

33.36.1 (73) : 09.4. **Wood preserving statistics for 1944.** *Wood Pres. News* 23, 1945 (92–4). P.R. [1926].

Statistics for 1944 of preservative treatment of 3,332,240,724 bd. ft. of wood (an increase of about 6·3 per cent. on the quantity treated in 1943), with comparative figures for both years, compiled by the U.S. Forest Service.

33.36.1 : 31.42 : 31.43. **Timber pests: their origin, prevention and cure.** Timber Development Association, 75 Cannon Street, London, E.C.4. 1945. pp. 60. P.R. [1927].

A survey of dry-rot and other fungi found in buildings; methods of prevention and eradication of decay; timber stains; attack by insects; occurrence of marine borers. Control measures are prescribed. The booklet is illustrated and a bibliography is appended.

33.36.1 : 31.43 : 13.2. ST. GEORGE, R. A. **Protection of log cabins, rustic work, and unseasoned wood from injurious insects.** *Fmrs'. Bull. U.S. Dep. Agric.* No. 1582 (slightly revised), 1943. pp. 22. [1928].

Control measure for bark beetles, ambrosia beetles, powder post beetles, roundheaded and flatheaded borers of unseasoned wood in the rough and manufactured, applicable primarily to the eastern and southern parts of the U.S., but of general interest. Seasonal activity of the insects and seasonal cutting are discussed with reference to conditions favourable or unfavourable to attack. Logs which are going to be used in the bark should be cut in October or November and stacked at once, either off the ground or under cover, so that the inner bark may dry rapidly before the beetles begin to fly in spring. Among the preventive measures described are (1) either spraying or immersion of logs and slabs in (*a*) a mixture of 1 part dichlorodiphenyl oxide and 3 parts kerosene, or (*b*) 1 part coal-tar creosote in 3 parts kerosene, or (2) the tree-injection or stepping method by which a tree is cut through at the base after the crown has been secured and prevented from falling; the cut end is then dipped in a tub of copper-sulphate or zinc-chloride solution and the tree is allowed to absorb the liquid for about 10 days. (Processed briefs of the procedure are available). For treatment after attack details are given of the use of orthodichlorobenzene and pentachlorophenol and also a schedule for kiln sterilization.

33.36.1 : 31.43 : 13.2 (68). TOOKE, F. G. C. **Beetles attacking seasoned timber in South Africa. Part 1. The common furniture beetle: *Anobium punctatum*, De Geer.** *Bull. Dep. Agric.. For. S. Afr.* No. 246, 1944. pp. 15. I.I.E. [1929].

Anobium punctatum has been recorded from the Cape Midlands and the Orange Free State where it is a recent introduction. An account is given of the life history (mainly from literature); in South Africa emerged beetles occur from October to February. Methods of control and eradication used in other countries are reviewed; of those tested in South Africa the Forest Products Institute recommends (*a*) immersion in a 5-per-cent. solution of zinc chloride or zinc sulphate, heated to 180° F. and allowed to cool, and (*b*) immersion in creosote to obtain an absorption of 5 lb. per cu. ft. of wood; and the Division of Entomology advises a mixture of pentachlorphenol 5 parts in 45 parts medium or heavy solvent naphtha and 50 parts Diesel gas oil, applied at the rate of 1 gallon to 80 sq. ft., which penetrates deeply and prevents reinfestation. A key to the diagnosis of borer damage in green wood and wood products is appended.

33.36.1 : 31.43 : 12.29. GARDNER, J. C. M. **A note on the insect borers of Bamboos and their control.** *Indian For. Bull.* (*n.s.*) *Entomology* No. 125, 1945. pp. [ii] + 17 + plates. [1930].

Certain qualities of the bamboo itself so far as they appear to affect control of borers are mentioned. Notes on the insect borers are given with special reference to the Bostrichidae, the most important family.

The amount of starch in the bamboo, which is intimately connected with liability to attack, varies with the season; also starch may under certain conditions decrease to nil in a culm in about 3 weeks after felling; in culms felled in hot dry weather starch is high to start with and shows little depletion after felling; such culms are liable to heavy attack if not treated against insect attack. Water immersion for 3 months prevents Bostrichid attack; the starch content in the immersed culms is not apparently altered, only the soluble sugars being removed.

A method devised for protection of hollow culms (internodal injection) is described. This appears entirely satisfactory for large-scale work. Impregnation of hollow culms with aqueous solutions of inorganic salts or creosote by the 'Basal incision method' is dealt with. Solid culms may be so impregnated if rubber tubes are used to convey the preservative (Boucherie). The leaf-suction method worked satisfactorily to draw the solutions of inorganic salts to considerable heights but is considered impracticable for large-scale work.

Baking culms has no deterrent effect against Bostrichidae unless the moisture content is reduced to near 5 per cent. and sufficient moisture to support Bostrichid life is not absorbed from the air subsequently. Superficial swabbing with creosote and fuel oil (or rape oil) gives temporary protection for about one year. Methods of impregnation with preservatives by soaking, open tank and pressure processes are briefly discussed. *Author's summary.*

33.36.1 : 31.43 (931) : 12.25. NEW ZEALAND. **State Forest Service: annual report of the Director of Forestry for the year ended 31st March, 1945.** Govt. Printer, Wellington. 1945. pp. 35. [1931].

In 1943 a test was initiated in co-operation with the Auckland Harbour Board to determine the resistance to marine-borer attack of creosoted exotic timbers and untreated indigenous timbers. A recent inspection indicated that nearly all the creosoted specimens are free from attack, though slight damage had occurred in a few which had received only a light treatment with shallow penetration of creosote. Untreated controls of the same species all showed heavy attack. Of the indigenous untreated timbers under test, Totara (*Podocarpus totara*) is the only species which has exhibited any marked resistance, attack being only slight (p. 15).

33.36.1 : 33.15.2 : 31.27. SCHRADER, O. H. **Tests on creosoted laminated stringers.** *Engng. News-Rec.* 135 (20), 1945 (80–3). P.R. [1932].

Eighteen laminated Douglas Fir beams of varying lengths were tested to determine the the effect of pressure creosoting on a cured phenolic-glue line and the strength characteristics of creosoted laminated railroad bridge timbers. The tests showed that pressure creosoting subsequent to lamination and curing had no deleterious effect on the strength of beams laminated with low-temperature phenolic-resin glue, nor on the bond strength and durability of the phenolic glue used. When incision was effected prior to pressure treatment in order to secure deeper and more uniform penetration of the preservative, there was a definite reduction in the bending strength of dry laminated beams.

33.36.1 : 33.52 : 12.26–8. TAMBLYN, N. **Service tests of fluorized Karri rail sleepers in Western Australia.** *J. Coun. sci. industr. Res. Aust.* 18, 1945 (254–62). D.S.I.R. [1933].

Tests were begun in 1929 to determine the preservative value of the fluorizing process for the treatment of green Karri (*Eucalyptus diversicolor*) rail sleepers. Treatment consisted in boiling the green sleepers in an aqueous solution of sodium fluoride, arsenious oxide and sodium dinitrophenate for ten hours, followed by a cooling period of 36 hours before the sleepers were removed from the solution. Three thousand fluorized Karri sleepers were installed in test sections of the Western Australian Government Railway system and the average service life of all fluorized Karri sleepers is now estimated at 13·0 years. Untreated Karri sleepers installed as controls in one test section only gave an average service life of 6·3 years compared with an estimated life in excess of 20 years for untreated Jarrah controls for the same section. Treated sleepers failed principally from decay, associated occasionally with termite attack. In some sections, where decay hazard was low, mechanical failure assumed importance in the later years of test. It is considered that the weakness of the treatment lay in the shallow penetration of the preservative and the susceptibility of the treated sleepers to end splitting, thus exposing the inner untreated wood to fungal or termite attack. *From author's summary.*

33.36.1 : 33.53 (931) : 12.25. New Zealand. **State Forest Service: annual report of the Director of Forestry for the year ended 31st March, 1945.** Govt. Printer, Wellington. 1945. pp. 35. [1934].

In 1931–2, 65 Rimu (*Dacrydium cupressinum*) poles treated with creosote by the hot-and-cold bath process and with varying absorptions were installed by the Post and Telegraph Department. Annual inspections have been made, and after 12–13 years' service, 63 of the poles are still sound and free from decay. In only two of the poles, which are still serviceable, was any decay discernible, and this occurred in poles which had received only light treatment. Untreated poles installed at the same time required renewing or strengthening after 2–4 years (p. 18).

33.36.1 : 33.53 : 12.25. Sedziak, H. P. **Results of the examination of Cuprinol ground-line and butt-treatment of Eastern White Cedar poles after two years' service.** *Advance Rep. 54th Ann. Meet. Canad. electr. Ass. (Engng. Sec.)* 1944 (5–10). [Forest Products Laboratories, Ottawa.] P.R. [1935].

A report dealing with 46 Eastern White Cedar pole stubs treated with Cuprinol and placed in the test plot of the Forest Products Laboratories, Ottawa, in October 1940. Half the treated poles were old 7-ft. lengths cut above the ground-line from old used poles, and the new test stubs were 7-ft. lengths cut from new 30-ft. Cedar poles. The Cuprinol treatment applied before installation of the stubs varied. 'K' treatment consisted in brushing two liberal flowing coats of Cuprinol from two ft. below to one ft. above ground-line. In addition, the treated portion of 5 of the new poles was wrapped in a bandage of ordinary 10-oz. burlap thoroughly treated with Cuprinol. 'L' treatment consisted in brushing on two liberal flowing coats to cover the butt completely to one ft. above ground-line. The results showed that the old poles soaked up and retained more Cuprinol than did the new poles, and the Cuprinol-treated burlap wrapping helped the new pole to take up more Cuprinol than the unwrapped poles. The untreated controls showed some decay at the ground-line in both old and new poles; but no decay was found in the treated area of any of the stubs, except, of course, the decay in the sapwood in the old stubs which was present at the time of the treatment. In the untreated sapwood towards the butt, decay had not progressed to the same extent in the ground-line-treated stubs as in the untreated controls. Two years is not long enough to draw definite conclusions on the relative effectiveness of the methods of ground-line treatment and additional test stubs have been treated to provide further information on service life. The results indicate, however, that Cuprinol treatment seems to be effective in inhibiting decay at the ground line for at least two years.

33.36.1 : 33.54 : 12.25. **Standard specification for creosote preservative treatment for Red, Jack and Lodgepole Pine poles and reinforcing stubs by pressure process.** Canadian Engineering Standards Association, Ottawa. *Stand. Specif.* No. C15 (D), 1940. pp. 12. P.R. [1936].

Cf. *For. Abstr.* 7 (No. 1950).

33.36.2. *Fireproofing*

33.36.2. **Albi-'R': new fire retardant coating material.** Albi Chemical Corporation, 9 Park Place, New York 7. 1945. pp. 4 + plates. P.R. [1937].

Albi-'R', for which a patent is being obtained, is applied like paint, dries with a flat, white, smooth surface, and does not peel. Extensive investigations and tests have proved its efficacy and permanency on wood, plywood, pulp and wood-fibre boards. The modified Schlyter test was applied to boards treated with this coating and the results of the tests are given in detail. In general, no flames appeared and smouldering only occurred in some cases, whereas untreated boards were entirely consumed in the same period.

33.36.2 : 31.42.1. **Fire-resistant treatment combats fungal decay.** *Timber News* 54, 1946 (58–9). P.R. [1938].

Tests were carried out on Scots Pine sapwood and Beech blocks 5 × 2·5 × 1·5 cm. to determine the resistance to fungal decay of wood treated by the Oxylene process. The samples were impregnated with a mixture of monammonium phosphate and borax; the quantity of salts per cu. ft. of timber and the proportions of each being the same as would normally be present after treating these two woods on a commercial scale. The treated Pine samples were exposed to attack by *Lentinus lepideus*, *Coniophora cerebella* and *Poria vaporaria*, and the Beech samples to *Polystictus versicolor* and *P. sanguineus*. On removal it was found that timbers treated with the Oxylene process showed no fungal decay whereas untreated controls were either heavily or completely decayed.

33.36.2 : 33.15 : 12.25. Reed, C. E. **Fire-retardant treatments for Douglas Fir plywood.** *Progr. Rep. Douglas Fir Plyw. Ass.* No. 32, 1945. pp. 21. P.R. [1939].

Brief discussions of fire-hazard characteristics, rates of combustion for wood and plywood, and methods of testing fire resistance, including detailed specifications of the severe Schlyter test as used in the Douglas Fir Plywood Association Laboratory. Data are presented on the flame spread, heat penetration and fuel-contributed factors for untreated plywood panels of various thicknesses, and on similar panels with two commercial chemical-salt and one resin-impregnation treatments, two overlay types, and twelve of the more effective proprietary and open-formula resin and paint coatings. *From author's summary.*

33.36.3. *Seasoning. Drying*

33.36.3. **Timber seasoning.** Timber Development Association, 75 Cannon Street, London, E.C.4. 1945. pp. 112. P.R. [1940].

Publications issued at various times by the Forest Products Research Laboratory, Princes Risborough, on timber seasoning, are now collected into one book. A bibliography is appended.

33.36.3. **Kiln drying.** *Pamphl. N.S.W. For. Comm. Div. Wood Technol.* No. 9, 1942 [1943]. pp. 28. [1941].

A general account of the subject, including stacking, sample boards, calculations, location in stack, kiln drying, difficulties experienced in kiln drying.

33.36.3 : 07.7. Sekhar, A. C. **Air seasoning of timber.** *Timb. Tr. J.* 176, 1946 (549–50). [1942].

A discussion of the advantages of movable bases for stacking timber for air seasoning. Diagrams are given of a type of movable base designed for use in the Curzon Saw Mills, Madras.

33.36.3 : 07.7. Desjardins, A. Des séchoirs et du séchage artificiel des bois de construction. **[Kilns and artificial seasoning of constructional timber.]** Ministère des Terres et Forêts, Québec. 1945. pp. 23. [F.] [1943].

A general account of the design and operation of kilns and the process of seasoning. Schedules are given for kiln drying of *Pinus strobus*, *P. resinosa*, Spruce (*Picea glauca*), Birch (*Betula lutea*), Lime (*Tilia glabra*), Maple (*Acer saccharinum*), Beech (*Fagus grandifolia*), Oak (*Quercus alba* and *Q. borealis*), Ash, in various dimensions.

33.36.3 : 33.92. Kollmann, F. Künstliche Holztrocknung und Holzlagerung. Holzbearbeitung Band 1. **[Artificial drying and storage of timber. Woodworking, Vol. 1.]** Reichsausschutz für wirtschaftliche Fertigung, Berlin. [1941]. pp. 80. [G.] L.C. [1944].

A concise treatise. The subject matter is discussed under the main headings: (i) Theory, with sections on wood structure; moisture content; movement of liquids in wood; shrinkage, swelling, warping and checking; case-hardening; and the theoretically correct course of drying. (ii) Practice, with sections on compartment, progressive, and veneer kilns; stacking under the various working conditions; determination of the appropriate stages of the drying process; rules for different woods; steaming; methods of testing and measurement for the purpose of supervision of drying plants; and the profitableness or otherwise of kiln drying. (iii) Storage of timber before and after drying. There is a bibliography of 12 references and an index.

33.38. Charcoal Manufacture. Use of Wood and Charcoal in Producer-gas Generators

33.38.2 : 07.7. Allcut, E. A., and Patten, R. H. **Gas producers for motor vehicles. First general report of the Subcommittee on Producer Gas of the Associate Committee on Substitute Fuels for Mobile Internal Combustion Engines, November, 1943.** National Research Council of Canada, Ottawa. 1944. pp. 162. *N.R.C.* No. 1220. [1945].

The Subcommittee on Producer Gas was appointed under the National Research Council of Canada to investigate the possibility of replacing petrol by gas made from charcoal or wood as a war-time emergency measure. A testing programme was devised and carried out to determine the kind of gas producer needed to meet Canadian conditions. Results of the tests are given in considerable detail and it is recommended that the manufacturing rights of the most satisfactory type of producer should be acquired for Canada. A standard specification for charcoal fuel is also included in the report. Fuel for 10,000 trucks would require 775,000 tons of hardwood to be cut and carbonized per annum. The present yearly production of charcoal would have to be trebled. The provision of this fuel could form part of the post-war reafforestation programme.

33.39. Manufacture of Sugar and Alcohol from Wood

33.39. Hunter, R. M. Dessauer Werke für Zucker und Chemische Industrie, Dessau. **[Dessau Works for Sugar and Chemical Industry, Dessau.]** Combined Intelligence Objectives Sub-committee. Item 22, File No. xxiii–8, 1945. pp. 4. L.S. [1946].

The plant was built in 1944; the maximum monthly production was 480,000 litres of 94-per-cent. ethyl alcohol, 1,600,000 kg. of 50-per-cent. lignin solution, and a quantity of albuminous material first used for stock feed, and later refined for human consumption. The lignin was sold for use in plastics. The process used is a refinement of the Bergius and Schöller (Munich) processes, and 100 kg. of dry wood yields 19–20 kg. of 100-per-cent. alcohol (containing a few higher alcohols) and 33 kg. of dry lignin. Brief details of the process are given.

33.5. *Pitprops. Sleepers. Poles and Other Roughly Converted Wood*

33.51. Great Britain. **Ministry of Fuel and Power: twenty-third annual report of the Safety in Mines Research Board, 1944.** H.M. Stationery Office, London. 1945. pp. 30. [1947].

Tests have been made on roughly squared props of British-grown Oak, to ascertain the sizes which are approximately equal in strength to round Baltic props of similar lengths, and to provide a basis for specifications. The props were unseasoned and the moisture content over 30 per cent. Oak props proved to be of ample strength compared with Baltic props of equivalent sizes. The average stress of 3,200 lb. per sq. in. at maximum load was one-third higher than that of Baltic props. The specification based upon these tests is as follows:—

Nominal size	3½ in.	4 in.	4½ in.	5 in.	5½ in.
Lengths	3, 3½, 4 ft.	3½, 4, 4½ ft.	4, 4½, 5 ft.	4½, 5, 5½ ft.	5, 5½, 6 ft.
Sum of 2 sides to be between	6½ & 7½ in.	7½ & 8½ in.	8½ & 9½ in.	9½ & 10½ in.	10½ & 11½ in.
Difference between 2 sides not to exceed	1 in.	1 in.	1 in.	1¼ in.	1½ in.
Minimum width of sawn face	1 in.	1 in.	1 in.	1 in.	1 in.

The minimum width of sawn face to be measured exclusive of bark, and no prop to be supplied, with a dead knot exceeding 1 in. diameter (p. 17).

33.51 : 12.25 : 43.3. ALBERTA. **Annual report of the Department of Lands and Mines of the Province of Alberta for the fiscal year ended March 31st, 1944.** King's Printer, Edmonton. 1945. pp. 127. [1948].

The manufacture of mining timbers is a considerable source of revenue. In most cases, the mine management insists on fire-killed timber, which they say is much stronger and more easily handled underground than green timber. In one mine green Pine timbers, 9 in. at butt, crumbled under the weight they had to carry, and were replaced with green Spruce of the same diameter which will remain in position indefinitely (p. 52).

33.51 : 31.37. CRESTIN, F Le choix des bois de mines. **[The selection of mining timbers.]** *Rev. Eaux For.* 83, 1945 (253–66). [F.] [1949].

The article consists mainly of a review of the literature on the subject. The specifications of the main groups of French mines are briefly described. Some account is given of methods developed at the laboratory of the Forestry School at Nancy for testing resistance to compression and static bending and modulus of rupture, and of the equipment available for carrying on this work when the school reassembles.

33.54 : 12.25 : 33.91. **Standard specification for Red, Jack and Lodgepole Pine timber for poles and reinforcing stubs.** Canadian Engineering Standards Association, Ottawa. *Stand. Specif.* No. C15 (C), 1940. pp. 20. P.R. [1950].

This specification covers the requirements for untreated Red, Jack and Lodgepole Pine poles and reinforcing stubs. The general plan has been to adopt such dimensions that different species of wood poles and reinforcing stubs can be directly considered on an equivalent basis for engineering or purchasing requirements. It is recognized that these Pine poles and reinforcing stubs are not generally used in pole line construction without being given a preservative treatment [cf. *For. Abstr.* 7 (No. 1936).]

33.6. *Packing Boxes, Crates, etc.*

33.6 (941) : 12.26–8. O'DONNELL, J., and GORRINGE, F. **Jarrah for butter boxes.** *Aust. For.* 9, 1945 (70–2). [1951].

When a shortage of butter boxes occurred in Australia in 1942, a number of local timbers was tried. After various tests it was found that clean Jarrah (*Eucalyptus marginata*), free from gum, rot, sap and pinholes, dried to 16 per cent. moisture content, and sprayed with a casein-formalin mixture, was free from taint and superior to the best imported box obtainable.

33.8. *Other Manufactured Products*

33.8. DUNKLEY, H. L. **The Oxford boat.** *Wood* 11, 1946 (45–7). [Imperial Forestry Institute, Oxford.] [1952].

Racing eights were constructed before the war with an outer skin of Cedar (*Cedrela mexicana*), $\frac{1}{8}$ in. thick, stringers, seat framing and diagonal strutting of Western White Pine (*Pinus monticola*) and ribs or timbers of Sycamore or Ash, only the last of which is now readily obtainable. An account is given in this article of the method of building such a boat.

33.9. *Grading and Storage of Converted Timber*

33.91 : 31.27. CHAPLIN, C. J. **Stress grading of timber: what it is and why it is needed in a competitive world for the future development of the use of timber in structures.** Timber Development Association Limited, 75 Cannon St., London, E.C.4. 1945. pp. 32. [1953].

The pamphlet has been written by the Timber Mechanics Officer at the Forest Products Research Laboratory at Princes Risborough, in order to present the engineer's point of view to the timber trade, and deals mainly with the reasons why the engineer needs stress-graded timber if he is to make the maximum use of wood as a construction material. The strength of a grade of timber may be limited or controlled by the following factors:—density and rate of growth; knots; checks; shakes and splits; slope of grain; decay and insect attack; sapwood (in damp situations). An account is given of existing stress-grading rules in various countries. A real benefit of marketing stress-graded timber is that personal opinion will no longer influence the choice of timber, since the real merit of stress-graded timber for structural purposes is its permissible strength, which, by the new convention, is included in the name of the stress-grade, e.g. 1,200 lb. European Redwood.

34. MINOR FOREST PRODUCTS AND THEIR UTILIZATION

34.2. *Vegetable Products*

34.2 (72 : 728 : 729 : 8) : 31.0. FOSBERG, F. R. **Principal economic plants of tropical America.** In *Plants and Plant Science in Latin America*. Chronica Botanica Company, Waltham, Mass. 1945. pp. 18–35. [U.S. Bureau of Plant Industry, Washington, D.C.] O.B.D. [1954].

General remarks and literature references on some of the more important economic plants of Latin America. The paper is divided into the following sections: food plants (native); food plants (introduced); forage; spices and flavours; perfumes; beverages, stimulants and narcotics; pharmaceutical plants; insecticides; oil plants; vegetable waxes; fibre plants; timbers; fuels; vegetable dyestuffs; tanning materials; latex-yielding plants; and gums and resins.

34.21. Fodder Grass and Grazing

34.21 (54.2) : 07.2. KANJILAL, P. C. **Grazing and pasture research in the United Provinces.** *Indian For.* 71, 1945 (417–22). [Sixth Silvicultural Conference, Dehra Dun (1945).] [1955].

The results of grazing and pasture research at Makhdoompur, Unao, U.P., up to March, 1939, led to the conclusion that closure during the rains is adequate and complete closure unnecessary. A further 5-year experiment in the same area confirms the previous deductions and further indicates:—(i) that periodic grazing for 8 months combined with monsoon closures is definitely preferable (from the point of view of grass production as well as simplicity in application) to rotational grazing for one month followed by 3 months' rest in rotation throughout the year, and (2) that, provided monsoon closures are regularly and effectually enforced, the production of grass is unaffected by the incidence of grazing during the rest of the year.

Further investigations are now proposed to confirm the above deductions and to determine the limiting incidence of grazing that can be applied to areas regulated under schemes of periodic (monsoon) closure, without causing the pasturage to deteriorate.

34.21 (54.3) : 07.2. LAMBA, G. S. **Grazing and pasture research in the Central Provinces.** *Indian For.* 71, 1945 (425–8). [Sixth Silvicultural Conference, Dehra Dun (1945).] [1956].

The experimental work done so far in the Central Provinces and Berar is summarized. The greater part of the paper deals with the development of a technique for correctly assessing the productivity of an area by an inexpensive method before the effects of two treatments can be compared. An area of not less than 6 acres should be selected and divided into plots of 66 × 66 ft. Fifty per cent. of these plots, selected by drawing lots, should be allotted to one treatment and the remaining fifty per cent. to the other. After the treatments have been applied and the grass is ready for harvesting, 25 quadrats 6 × 6 ft. should be laid out in each plot, again by drawing lots, and the herbage in each assessed ocularly. The data so recorded in the investigation described, was as follows: (1) density of stocking; (2) the prevailing type of herbage, (*a*) important fodder species, (*b*) less important fodder species, (*c*) non-fodder species; (3) percentage area occupied separately by species in the case of (*a*) and (*b*) and collectively for all species in the case of (*c*) and the percentage of the unoccupied area. This technique can be used for comparing the effects of such treatments as burning, weeding at various intensities, harrowing, manuring, re-seeding, etc.

34.23. Wood Ash. Potash

34.23. LUNT, H. A. **The value of wood ashes as fertilizer.** *Bull. Ntheast. Wood Utiliz. Coun.* No. 7, 1945 (14–20). [Connecticut Agricultural Exp. Sta., New Haven, Conn.] P.R. [1957.]

A review of the composition and value of wood ashes in general. Values may range from $3·50 or less to $10·00 per ton on the farm or within short carting distance. Composition of wood ash varies with the method of burning, age of the tree, species and part of the tree used. Old trees yield less ash, with a slightly lower potash content, than young trees. Conifers generally contain less ash and have a lower potash content than deciduous trees. Bark yields a large amount of ash, considerably lower in potash and somewhat higher in lime than ash of wood. Comparative data for ash composition of various species are tabulated.

It is not advisable to depend upon wood

ashes alone to correct acidity, especially if the soil lime-requirement is high. It is better to govern the rate of wood-ash application by the amount of potash needed rather than on the basis of its neutralizing power. The following formula can be used in calculating the amount of ashes (or any other material) needed to supply a given amount of potash:

$$\frac{\text{Amount of potash desired}}{\%\ K_2O \text{ in ashes (or fertilizer)}} \times 100 = \begin{array}{l}\text{pounds of}\\ \text{ashes or}\\ \text{fertilizer}\\ \text{needed.}\end{array}$$

34.24. Tanning Materials

34.24 : 12.25 (494). Engler. Schweizer Fichten-Gerbrinde. **[Swiss Spruce tanbark.]** *Schweiz. Z. Forstw.* 96, 1945 (356–65). [G.] [1958].

The shortage of tanbark in Switzerland began in 1938 with the reduction of imports of Spruce bark from Austria, owing to political circumstances, and, with the advent of war, overseas imports stopped. As a result, Swiss production of home-grown Spanish Chestnut tanwood, which was already considerable, was increased and production of home-grown Spruce tanbark rose to 6–8 times the normal peace-time figure. The difficulties in utilizing the latter are that it must be derived from summer fellings (as the bark only peels readily in the growing season), when the moisture content is about 75 per cent., and that it must be dried rapidly, particularly as the high content of sugars and similar substances renders it very susceptible to attack by micro-organisms. Tannin content varies with age of tree, locality and soil, but may be roughly assessed by the thickness of the fleshy portions of the bark, thin dry bark usually containing the lowest percentage of tannins. Progress in collection and drying has been such that whereas in 1940 about 15 per cent. of samples had a moisture content of more than 17 per cent., and 10 per cent. had a tannin content below 8 per cent., in 1943 only 3 per cent. of samples had over 17 per cent. of moisture and none less than 8 per cent. of tannins. The maximum permissible moisture appears to be 18 per cent. The results of tests on bark from winter fellings and from pulpwood barked at paper mills were unpromising.

34.24 : 12.25 : 12.26–8 (43.1–5). Huber, B. Die Deckung des Gerbstoffbedarfes im Kriege. **[Meeting the demand for tanstuffs in war-time.]** *Abstr.* in *Forstwiss. Cbl. u. Thar. forstl. Jb.* No. 1, 1944 (40–3). [G.] [1959].

Tanbark production in the traditional Oak-coppice areas, even under war-time stimulation, could cover barely 10 per cent. of Germany's requirements. Trials of an old method, in which standing Oak is barked in summer to a height of about 4 m. and the tree then left for winter felling, gave satisfactory quality and yield of bark for trees up to 50 years old. This method was officially recommended, but only where sale of the bark was assured, since tanneries appear to have been suspicious of the product.

Research on Spruce showed that the ease of bark stripping during the sap period was directly related to the activity of the cambium in cell division and depended on softening of the cambial cell walls by growth substance. Two suggested methods of prolonging the period of ready peeling are felling late in winter and leaving the logs to lie until the sap period, and girdling trees to secure accumulation of growth substance. In view, however, of the undesirability of more summer felling than is necessary, further research was directed towards means of utilizing bark from normal fellings. Grassmann and Kuntara found that a mild sulphite treatment, as usual in chemical pulping, gave considerably increased tannin yields owing to the conversion of phlobaphenes into a soluble form. It was also shown that the deterioration of such bark during wet storage was due not so much to leaching as to conversion of tannins to phlobaphenes, and the sulphite treatment could therefore be applied. Since this conversion is due to enzymes, a test was made of steaming to 'kill' the latter, and from two forest districts 273 metric tons of steamed bark were produced which had an average tannin content of 13·8 per cent.

Trials were also made of other tannin-bearing plants. *Saxifraga* (*Bergenia*) *crassifolia* was unsuccessful, being unable to compete with the native flora and liable to deer browsing damage. *Rhus typhina*, on the other hand, was proved winter-hardy and eminently suitable for cultivation: its leaves, gathered shortly before autumn coloration, contained over 25 per cent., and in high-yielding strains up to 30 or 40 per cent., of tannins. On favourable soils the yield of pure tannins is several hundred kg. per ha. annually.

Progress had also been made in the production of synthetic tanstuffs.

34.24 : 12.26–8 : 82 (43.1–5). MÜLDER, D. Eichengerbrindengewinnung im Forstamt Dammendorf. **[The production of Oak tanbark in the forest district of Dammendorf.]** *Forstarchiv* 20, 1944 (67–73). [G.] [1960].

A general account, with emphasis on efforts to increase war-time production (13 Doppelzentner in 1938, 175 in 1943, and capable of further improvement), under headings dealing with organization of the work, including conversion to a piece-work basis; notes on barking, bundling and transport; relation of bark yield to solid and stacked wood volume; working performances in connexion with the assessment of piece-work rates; financial results for 1942; planning with regard to manpower and growing stock; conditions affecting sale; and a brief note on some 1943 data.

34.24 (54). BADHWAR, R. L., DEY, A. C., and EDWARDS, M. V. **Vegetable tanning materials in India. Part 1. Survey.** *Indian For. Leafl.* (*Chem. & minor For. Prod.*) No. 72, 1944. pp. 39. [1961].

During the war, tanners in India found it increasingly difficult to obtain sufficient indigenous supplies of tanning material. This leaflet gives a complete list of all the known vegetable tanning materials found in India, with the percentage of tannin when known. The big industrial concerns use only Babul (*Acacia arabica*) bark, Myrobolans (*Terminalia chebula*), Avaram (*Cassia auriculata*) bark, and Black Wattle (*A. mollissima*) bark. A number of other species are already used to some extent, and there are many more which might be of considerable use to tanners. *From authors' summary.*

34.24 : 12.26–8 : 12.11. KURSANOV, A. L. Prevrashcheniya dubil'nȳkh veshchestv u iv v period vesennego rosta. **[Changes in the tannin substances in Willow during the period of spring growth.]** *Biokhimiya* 9, 1944 (322–36). [Russ.e.] C.G.B. [1962].

Experiments with 7 species of *Salix* showed that energetic synthesis of substances of the tannin group occurred in the bark at the onset of sap flow, before root and shoot growth, almost doubling the total content of this group of substances. At the same time, owing to condensation of such substances, there was an increase in the relative content of soluble tannin and its insoluble adsorbed forms and a decrease in that of the polyphenols and catechins. During shoot and root development this process was reversed, and part of the tannin condensation products was converted into simpler compounds, some translocation of tannin substances from the bark into the growing parts occurring simultaneously.

When shoots were grown in the dark, synthesis of all tannin substances stopped after the greater part of the carbohydrates had been used up. In roots and etiolated shoots a characteristic feature was the high percentage of the simpler compounds of the polyphenol and catechin types.

In the light there was rapid synthesis of tannin substances in growing shoots, tannin and its adsorbed forms increasing most, while polyphenols and catechins slightly decreased. During the first month of growth the total bark tannins increased by 25–100 per cent. compared with those at the onset of growth.

Assimilating leaves were considerably richer in polyphenols and catechins than was bark several years old. Whereas, in the dark, synthesis of tannins proceeded at the expense of sugars, in the light, photosynthesis was accompanied by the formation of phloroglucin, which is probably to be regarded as the first polyphenol to be formed from sugar.

Phloroglucin, a constant associate and component of tannin substances of the condensation type behaved in the bark similarly to other fractions of the tannin complex during the phases of spring growth.

Glucosides also behaved similarly to other tannin substances, serving for the temporary stabilization of polyphenols or other reactive phenolic substances, which in a free form might be harmful to the living protoplasm.

The results indicate that the tannin substances have a definite physiological activity, as yet imperfectly understood. During spring growth their behaviour is similar to that of other reserves such as starch, proteins, etc. In contrast to these, however the tannin substances, though synthesized in the first place from non-phenolic substances, subsequently appear to undergo only such changes as do not involve transformation into non-phenolic compounds.

34.25. Christmas Trees. Medicinal Plants

34.25 (71). GUIMONT, A. Santa Claus et sylviculture se feront la grimace. **[Santa**

Claus and silviculture will come into conflict.] *For. québec.* 10, 1945 (360–2). [F.] [1963].

The advantages and disadvantages of the Christmas-tree trade, from the silvicultural point of view, are discussed. It is concluded that the two are not incompatible and that the trade may be profitably carried on by felling trees on pastures suitable for cultivation, planting Christmas trees in the free spaces of plantations of slow-growing species, and cutting Christmas trees when thinning stands. The trade needs organizing in order to become profitable; at the present time the producer gets only 5 to 25 cents for a tree which may cost the Canadian consumer $2 to $3·75. Bad practices, which should be stopped, are unrestricted cutting in the forest and cutting the top off a tree, leaving the lower part standing.

34.25 : 12.26–8. Siddiqui, S., Misra, S. C., and Sharma, V. N. **Chemical examination of *Holarrhena febrifuga* Klotzsch. Part I.** *J. sci. industr. Res., India* 3, 1945 (555–8). L.S. [1964].

Tests were carried out in India to determine the alkaloidal constituents of *H. febrifuga*, a native of E. Africa. The average values for the percentage of total alkaloids in various parts of the plant were:—

Bark from slender twigs	*Decorticated twigs*	*Bark from stem*	*Decorticated stem*	*Leaves*
1·4	0·8	2·4	0·2	0·2

H. febrifuga was found to have a higher conessine content than *H. antidysenterica*, also used as a drug.

34.25 : 12.26–8 (94). Loftus Hills, K., Trautner, E. M., and Rodwell, C. N. **A preliminary report upon variation in the nature and quantity of the main alkaloids in *Duboisia myoporoides* and *D. leichhardtii*.** *J. Counc. sci. industr. Res. Aust.* 18, 1945 (234–53). D.S.I.R. [1965].

Eighty-two samples of leaf collected from individual trees scattered throughout the known distribution areas of the species were investigated. Certain of the trees were sampled on different occasions and young plantation material growing at Nambour (Queensland) and Canberra was sampled at regular intervals over a period of a year or more. Considerable variations in both the quantity and the nature of the alkaloids was revealed. It is evident that the frequency distribution of alkaloid population types controls the alkaloid content of aggregate samples from natural stands, and that, although considerable variation may occur from time to time in individual trees, the balance, on the average, favours hyoscine in the northern section of *D. myoporoides* and hyoscyamine in *D. leichhardtii* and in the southern area of *D. myoporoides*. Changes occurred in plantation material during the twelve months, the major alkaloid changing from hyoscine to hyoscyamine and vice versa. Nevertheless the average composition of both species throughout the year was much the same as that of natural stands. The assay method used, which has several novel features, is described, and its interpretation is discussed in some detail. *Authors' summary.*

34.25 : 12.26–8 (79 : 71.1). Arnst, A. **Cascara—a crop from West Coast tree farms.** *J. For.* 43, 1945 (805–11). [Soil Conservation Service, Sedro-Woolley, Wash.] [1966].

Rhamnus purshiana, the source of medicinal cascara, is found in commercial quantities in a coastal strip from California to south British Columbia. The annual bark crop supports a large industry. Its scattered growth, wide range, and the rare occurrence of extensive pure stands make an accurate inventory difficult, but the natural growth is undoubtedly being depleted by bad methods of harvesting. Trees are usually stripped of bark and left to die, whereas, if cut to a proper stump height, they would coppice vigorously. Moreover, immature trees of 2 or 3 in. diameter and less, are frequently barked. The high prices obtaining for bark and the difficulty of conserving the natural supplies, are encouraging the growth of cascara as a plantation crop. This article gives some account of the methods of collecting and preparing seed, planting, tending, and harvesting the crop. It is believed that in a properly spaced plantation each tree will produce bark at an annual rate of 0·8 lb. on a 15-year rotation. At that age, the average tree should be 5–6 in. in diameter; will yield 12–15 lb. of dry bark and can be peeled economically. The bark crop should be harvested in an economical manner and the tree cut down to 6 in. above ground level, leaving the stump unpeeled. The resulting sprout growth on the stumps should be thinned during the first year to 3–4 of the better stems which can be allowed to mature to crop trees. Coppice grows faster than seedlings, and a second crop may be expected in 10–12 years if the sprouts are thinned. It has been suggested, also, that by proper pruning, an annual crop of bark can be obtained without killing the whole tree. Some experimenters have claimed that cascara peeled at certain times in late spring will put on a new coat of bark. Examples of this have been seen but not consistently enough to justify recommendation of the practice.

34.26. Resin. Turpentine. Oils. Rubber. Latex

34.26 (72 : 728 : 729 : 8). GUENTHER, E. **The production of essential oils in Latin America.** In *Plants and Plant Science in Latin America.* Chronica Botanica Company, Waltham, Mass. 1945. pp. 205–10. [Fritzsche Brothers, Inc., New York City.] O.B.D. [1967].

Most essential oils are produced on the basis of primitive family industry, and only in a few instances have advanced processing methods, based upon modern agriculture and engineering, succeeded, by mass production, in competing successfully with this low-priced labour. Annotated lists are given of those oils which are actually being produced in Central and South America, including the West Indies, at the present time, and of others which, from the practical point of view, should or could be considered for production in the same area. Scientific and practical agricultural research, studies on the selection of high-yielding varieties, and investigations into conditions of soil, climate, weather and insect pests must precede the laying-out of actual plantings, and the first experimental lots of oil distilled in a small pilot plant should be submitted for expert advice on the quality of the product and its adaptability to the actual market demands.

34.26 (72 : 728 : 729 : 8). MARKLEY, K. S. **Fat and oil resources of Latin America.** In *Plants and Plant Science in Latin America.* Chronica Botanica Company, Waltham, Mass. 1945. pp. 211–8. [Southern Regional Research Laboratory, New Orleans, La.] O.B.D. [1968].

The Latin American Republics, taken as a whole, possess one of the greatest actual and potential sources of vegetable fats and oils in the world. Not only are vast quantities of these products ready for exploitation at present if better transport and labour facilities were available, but owing to the wide variety of climates and soil types, Latin America is capable of producing many additional types of fats and oils. As well as the growing demands for these products in the home market there is the possibility of a considerable export trade.

The author lists and briefly discusses the main plant sources of oils and fats. These include Babassú (*Orbignya barbosiana*), Coconut (*Cocos nucifera*) and related Palms, Dende Palm (*Elaeis guineensis*), Oiticica (*Licania rigida*), *L. arborea*, *Ouratea castaneifolia* *Theobroma cacao*, Myristicaceae, *Copernicia cerifera*, *Syagrus coronata*, *Aleurites fordii* and *A. montana*.

34.26 : 12.11.3 : 12.26–8 : 23.25. WEBSTER, C. C. **Improved planting material of the Tung tree: a progress report.** *E. Afr. agric. J.* 11, 1945–46 (165–9). [Tung Exp. Sta., Department of Agriculture, Nyasaland.] [1969].

In a seedling plantation of *Aleurites montana*, it was found that some 40–50 per cent. of the trees are predominantly male and therefore bear very little fruit, while there is considerable variation in yield among the bearing trees, the majority giving only moderate yields, while a small proportion are exceptionally good. Experiments are in progress for the selection of the best bearing trees from seedling plantations and their vegetative propagation, in order to eliminate the large proportion of males and form plantations consisting of clonal material derived only from the best bearers. Budding on to seedling rootstocks presents no difficulties and so far propagation has been entirely by this method. The present article gives a report of progress in these experiments at the Tung Experimental Station in Nyasaland.

34.26 (97). SUTER, A. F. **Natural resins of the British Empire.** *Crown Colonist* Oct., 1945 (711). O.G. [1970].

The writer discusses briefly the prospects of natural resins (particularly the copals of Nigeria, Gold Coast, Sierra Leone, Kenya and Tanganyika, and the damars of North Borneo, Malaya, Sarawak and Ceylon) in competition with synthetic resins, and suggests that the properties of natural resins are a suitable subject for research by the Colonial Products Research Council.

34.26 (97) : 12.25–8. ISLIP, H. T. **Essential oils: potentialities of a minor industry.**

Crown Colonist Sept., 1945 (637–40). O.G. [1971].

The article reviews the production of essential oils in the Colonial Empire. World production of essential oils (excluding turpentine oils) amounted in normal times to about 10,000 tons per annum. The Colonial Empire's contribution to this total is not large, but a large proportion of the world's supply of some particular oils (e.g. Citronella, Lime and Patchouli) comes from Colonial sources. Some account is given of the cultivation and production of these oils in the different colonies. Of those derived from tree species the most important are Lime (*Citrus medica*) and Orange, Bay oil (*Pimenta acris*) and Pimento oil (*P. officinalis*) from the West Indies. Cinnamon leaf oil and bark oil (*Cinnamomum zeylanicum*) from Ceylon and Seychelles; East African Cedarwood oil (*Juniperus procera*) from Kenya; Cassie (*Acacia farnesiana*) from Palestine; Camphor (*Cinnamomum camphora*) from Tanganyika.

34.26 : 12.25. CEYLON. **Silvicultural Research Administration, 1943.** Typescript. 1945. pp. 14. [1972].

Copious exudations of a clear hard resin of 'tear-drop' form were observed from certain pruned trees of *Callitris calcarata*, and later it was found that other, unpruned, trees of this species and of *C. glauca* exuded resin from incipient cracks in the bark of stem and branches. Chemical analysis of this gum was favourable and a set of exploratory tapping operations has been initiated, though the yield at present is small (p. 12).

34.26 : 12.25 (43.1–5). WIENHAUS, H. Untersuchungen an Terpentinen und Holzextrakten unserer Nadelbäume. **[Research on turpentines and wood extracts of German conifers.** (A review).] *Abstr.* in *Forstwiss. Cbl. u. Thar. forstl. Jb.* No. 1, 1944 (35–7). [G.] [1973].

34.26 : 12.26–8 (67.8). HILL, A. G. G. **Camphor production in East Africa from *Cinnamomum camphora*.** *E. Afr. agric. J.* 11, 1945–46 (148–56). [East African Agricultural Research Institute.] [1974].

An account of the design and working of the war-time camphor factory erected at Lushoto, Tanganyika, in 1941–2, for producing camphor from the plantations of *Cinnamomum camphora* in the East and West Usambara Mountains. Details are given of the machinery, the manufacturing process, labour requirements, yields and cost of production. The prospects of establishing a permanent camphor industry in East Africa are discussed. These depend on ability to compete in price with the natural product of the Far East and the synthetic product of Europe and America. Since no large Camphor forests exist in East Africa, the prospect of establishing a camphor industry within a reasonable period must lie in the exploitation of short-term Bush Camphor cut on a coppicing system or on one of the camphor-yielding herbs, such as *Ocimum kilimandscharicum*. An experimental area of Bush Camphor has been planted at Lushoto. Experiments with *Ocimum* species show that the yield of oil and the camphor content of the oil are subject to considerable variation depending on the time of harvesting and probably on other factors.

34.26 (54). BUDHIRAJA, K. L., and BERI, R. **Common latex bearing woody plants of India.** *Indian For. Leafl.* (*Chem. & minor For. Prod.*) No. 70, 1944. pp. 18. [1975].

Over 150 latex samples from 46 species belonging to 6 families were examined. With the exception of *Cryptostegia grandiflora*, none of the species was found to contain a high proportion of caoutchouc with proportionately low resin, but a few species, e.g. *Palaquium* (*Dichopsis*) *ellipticum*, *Madhuca* (*Bassia*) *latifolia*, *Ficus glomerata*, *Wrightia tinctoria*, *Tabernaemontana heyneana*, *Wrightia tomentosa* and *Poinsettia pulcherrima*, although having a high resin content, have also 15 per cent. or more of rubber and might, therefore, find some use where a rubber content of more than 10–30 per cent. is not required. *From authors' summary.*

34.26 (54) : 12.26–8 : 34.25. DUTTA, N. L., and KARIMULLAH. **Chemical examination of the dried latex from *Euphorbia tirucalli*.** *J. Coun. sci. industr. Res., India* 3, 1944 (212). I.H. [1976].

The small African tree, *Euphorbia tirucalli*, which has become naturalized in the drier parts of Bengal, the Deccan, and Ceylon, produces a juice which has useful medicinal properties. Data are given on the composition of the dried latex of the species (obtained from South India). Apart from the compounds investigated by the authors, the dried latex contains about 70–75 per cent. of a resinous material.

34.26 : 12.26–8. Naghski, J., White, J. W., Hoover, S., and Willaman, J. J. **Anaerobic fermentation of *Cryptostegia* leaves for recovery of rubber.** *J. Bact.* 49, 1945 (563–72). L.S. [1977].

Fermentation for two days of pre-boiled *Cryptostegia* leaves by *Clostridium roseum* at 35–45° C. caused a loss of 60 per cent. in the original dry weight of leaves and a 75-per-cent. loss in the crude cellulose. The rubber content of the product was more than two and a half times that of the original material on a moisture-free basis. Parenchyma protoplasts were liberated by destruction of their cell walls. Fermented leaves were screened to separate the protoplasts containing the cell rubber from the latex rubber in the other fraction comprising veins, epidermis and cuticle. The protoplasts were resistant to acid action but were dissolved by dilute alkali; the liberated rubber globules rose to form a cream. It was established both microscopically and chemically that *C. roseum* ferments the cellulosic fractions of leaves *in situ*.

34.26 : 12.26–8 (72 : 8). Uphof, J. C. T. **Certain minor rubber producing plants in the Western Hemisphere during times of emergency.** In *Plants and Plant Science in Latin America*. Chronica Botanica Company, Waltham, Mass. 1945. pp. 201–2. O.B.D. [1978].

Among the rubber-producing plants which have proved useful in times of emergency are *Sapium* spp., *Hancornia speciosa*, *Micrandra siphonoides*, *Jatropha* spp., *Euphorbia intisy* and *E. fulva*. The general distribution of these species and the quality of their rubber are briefly indicated.

34.26 : 12.26–8 (79.4 : 79.1 : 78.9 : 76.4). Gross, L. S., and Perry, E. L. **Forest and guayule.** *J. For.* 43, 1945 (871–6). [Emergency Rubber Project, U.S. Forest Service, Los Angeles, Calif.] [1979].

An account of the production and harvesting of Guayule (*Parthenium argentatum*) under the Emergency Rubber Project [cf. *For. Abstr.* 6 (109)]. Only some 32,000 acres were actually planted, mostly in California. Though still immature, this crop is now being harvested and processed because of the shortage of natural rubber. The article describes the process of collecting, threshing and testing seed, preparation of nurseries, planting, tending, harvesting, and rubber extraction. The future of Guayule production in the United States is still uncertain, but it has been proved that the crop can be grown successfully over a large extent of the country and that it is capable of supplying a considerable part of the nation's needs.

34.27. Seeds. Fruits. Leaf Fodder. Fibres and Flosses

34.27 : 34.24 : 34.26 : 12.26–8. Velez-Salas, F. **Coco de mono; a tree containing tannin, oil, and fat and serving as a depilatory.** *Rev. farm, B. Aires* 87, 1945 (161–5). Chem. Abstr. 39, 1945 (4720). P.R. [1980].

Coco de mono or *Lecythis pisonis* produces seeds of almond type which contain: Oil 39·28 per cent.; gums, glucose, starch, proteins 23·55 per cent.; emulsin 2·95 per cent.; milky and parenchymatic material 11·75 per cent. The oil has d_{15}0·9201 and is similar to sweet almond oil. The germ contains carbohydrates 4·53 per cent.; oil 2·76 per cent.; H_2O. The seeds contain 12 per cent. of a tannin. The emulsion of the almonds has an anticatarrhal and diuretic action. The oil acts as a purgative. The latex of the pericarp is used by the South American natives as a depilatory.

34.27 (54). Laurie, M. V. **Fodder trees in India.** *Indian For. Leafl.* (*Silviculture*) No. 82, 1945. pp. [iii] + 17. [1981].

This publication was originally compiled in 1939 and published locally [see *For. Abstr.* 2 (320)]. The present reprinting is the third edition and it has been decided to publish it as an *Indian Forest Leaflet*. Suggestions for alterations and additions are invited.

34.27 (7 : 8). Dewey, L. H. **Fiber production in the Western Hemisphere.** *Misc. Publ. U.S. Dep. Agric.* No. 518, 1943. pp. 95. [1982].

This publication treats of plant fibres, other than cotton and flax, now produced commercially in the Western Hemisphere, and includes brief notes on others produced on a smaller scale. The tree species from which fibres are obtained are various Palms, Kapok (*Ceiba pentandra*), Pochote (*C. aesculifolia*), Northern Pochote (*C. acuminata*), Palo Borracho (*Chorisia insignis*), Samshu (*C. speciosa*). Fibre is obtained from the leafstalks of Palms, and from the seedpods of Kapok and the other species mentioned above. Treebeard (*Tillandsia usneoides*) from Cypress swamps is also used.

34.27 : 12.26–8 : 12.14.7. KERPEL, D. A. **Microscopical anatomy of tropical plants. II. Observations on the development of kapok hair.** *Repr.* from *Ann. Jard. bot. Buitenz.* 48, 1938 (173–86 + plates). L.C. [1983].

The floss of *Ceiba pentandra* Gaertn. arises from the epidermis of the inner side of the pericarp. Owing to lack of space for development longitudinally, it curves and has an undulating, deformed appearance which is accentuated by torsion in the drying hairs. There are indications that the wall is perforated by sub-microscopic pores through which water and different solutions penetrate into the lumen of the hairs. During this process the air in the lumen is dissolved by the penetrating liquids. The waxy cuticle, however, protects a mass of hairs against wetting and thus against the above-mentioned penetration of liquids, so that the floating capacity of the kapok mass is not influenced by water. The great lumen of the hairs and their undulation are important factors in procuring the floating capacity of the kapok mass, as these factors decrease the apparent specific weight. *From author's summary.*

34.27 : 12.26–8. ERGLE, D. R., ROBINSON, B. B., and DEMPSEY, J. M. **Malvaceous bast fibre studies.** *J. Amer. Soc. Agron.* 37, 1945 (113–26). L.S. [1984].

Hibiscus cannabinus, *H. sabdariffa* var. *altissima* and *Urena lobata* were grown experimentally in Alabama and studied for possible utilization as sources of bast fibre in time of national emergency. Maximum yields in pounds per acre of mill-run fibre, produced under the experimental conditions described, were: *H. cannabinus* 3,103; var. *altissima* 2,791; *Urena lobata*, at the 25-lb. seeding rate, 1,482, and at 50-lb. seeding rate 2,016, which may be considered good when compared with yields reported in countries where these plants are grown commercially. A chemical method of extraction was developed and used to follow the changes in pure fibre content of the plants throughout their growth cycle. It gave lower but consistent and reproducible results as compared with those obtained by biological retting and subsequent mechanical extraction. A study of the progress of fibre formation during the growth and development of the plants showed somewhat similar increases in the fibre content during early growth and decrease in extractable fibre content near maturity. The results of retting tests showed that the fibres from water-retted plants were superior in strength and quality to those obtained from dew-retted plants, and water-retting was accomplished in a shorter time. Mechanical extraction of the fibres in a hemp-tow fibre mill was investigated. The stalks of var. *altissima* and *Urena lobata* were easily decorticated and yielded a relatively clean fibre. Under conditions of experimentation the fibres of var. *altissima* and *Urena lobata* were superior in strength to those of *H. cannabinus*.

34.6. *Utilization of Logging and Milling Waste*

34.6. ARIES, R. S. **Outlets for waste wood.** *Timber of Canada* 6 (2), 1945 (51, 55–6, 61–3). [Polytechnic Institute, Brooklyn, N.Y.] [1985].

A review of the present uses of waste wood, particularly sawdust and shavings, as fuel, for gas producers, briquettes, floors, concrete, stuccos and plasters, other compositions, wood flour, fibre board, charcoal, distillation, mechanical uses for wastes of larger size, and excelsior manufacture.

34.6 : 33.17. BOOMSMA, C. D. **The disposal of sawmill waste.** *Aust. For.* 9, 1945 (53–60). [1986].

Methods of disposing of waste of large and small Australian sawmills are discussed. For small mills, disposal by burning in an enclosed incinerator is recommended because it is safe and efficient compared with the creation of a dump, which is expensive and raises fire hazard. Large mills burn most of their waste in the furnace. It is hoped that utilization of waste will be developed in Australia. *Author's summary.*

34.6. AUSTRALIA. **Council for Scientific and Industrial Research, Division of Forest Products: annual report for the year 1944–45.** Forest Products Laboratory, 69–77 Yarra Bank Road, South Melbourne. 1945. pp. 43. [1987].

Work is in progress to test the value of 'sawdust-cement' (a combination of sawdust, Portland cement, and sand) as a flooring surface. Experimental tests have so far shown that hydrated lime is valuable in ensuring good setting properties; calcium chloride is useful in securing high early strength; water proportions are critical, in regard to both strength and trowelling qualities; shrinkage is much higher than in normal concrete, and special care must

be taken in bonding on to the base aggregate (p. 25).

34.6 : 11.47.1. MIDGLEY, A. R. **The use of sawdust, shavings and superphosphate with dairy manure.** *Bull. Ntheast. Wood Utiliz. Coun.* No. 7, 1945 (27–36). [Vermont Agricultural Exp. Sta.] P.R. [1988].

Investigations were carried out to determine the water-absorbing capacity of fine and coarse sawdust, Pine shavings, and mature chopped hay used for bedding. One-lb. samples of these materials were mixed with liquid; after six hours the excess was removed and the increase in weight due to absorption of water was determined. Fine sawdust retained most liquid but coarse sawdust and shavings also compared favourably with mature chopped hay. In another experiment, temperature changes were determined as a means of estimating bacterial activity. Five-lb. samples of fresh cattle manure were mixed with chopped hay, shavings and sawdust respectively, and incubated in partially insulated jars at room temperature. Shavings and sawdust were found to supply active energy material and to raise the temperature of manure to the same extent as mature hay. It is concluded that, as sawdust and shavings are more readily available and are cheaper than straw, their use would be financially advantageous to the farmer, especially if superphosphate were added to increase the crop-producing value.

34.6 : 11.47.1 : 33.32. DUNN, S. **The use of lignin in potato fertilizer.** *Bull. Ntheast. Wood Utiliz. Coun.* No. 7, 1945 (21–6). [New Hampshire Agricultural Exp. Sta.] P.R. [1989].

Experiments were begun in New Hampshire to test the effects of lignin with, or without, sulphur on the growth and starch quality of potato plants when added to the soil. The plants were grown from cut seed in sandy loam with thin layers of lignin between layers of soil (ratio, the equivalent of 5 tons to the acre) and commercial fertilizer was added. Marked stimulus to growth occurred in the early stages but differences were less later. Lignin-treated plants were deeper in colour and had more foliage. Plants grown with lignin yielded the greatest weight of tubers, those grown with lignin and sulphur almost as much, and those grown with fertilizer only the least. The starch content of the tubers from lignin-treated plants is markedly greater than the others, while moisture content is considerably less.

34.6 : 33.02. MACBEAN, A. P. **The Ladysmith experiment in salvaging pulpwood from logging waste, 1943–44.** *For. Chron.* 21, 1945 (240–53). [1990].

The experiment described was undertaken in co-operation by a logging company, a pulpmill company and the British Columbian Forest Service. Its object was to find a means of economically using sound wood left in the forests of British Columbia, which often exceeds in volume the wood harvested from an eastern forest. Salvaging has been completed on an area of 260 acres with a total recovery of about 400,890 cu. ft. After losses through breakage and decay, the actual scale of sound wood delivered was 370,760 cu. ft., the equivalent of 2 million bd. ft. B.C. Log Scale of normal pulp logs. The original logging produced 6,405 cu. ft. per acre, and the salvaged wood (1,550 cu. ft. per acre) amounts to 24 per cent. of the sawlog value and to 19 per cent. of the utilized stand. Over 30 per cent. of the salvage came from long tops which were left from trees which yielded sawlogs. The material ranged in length from 10 to 90 ft. and in diameter from 3 to 18 in. The average piece, with a diameter of 6·1 in. and a length of 34 ft., contained 12·5 cu. ft. Light, fast, mobile, yarding machines were designed for the operation. These consisted of a truck on which was mounted an independently powered (Chrysler, industrial engine, T-120, with fluid drive clutch) winch and a 28-ft. A-frame boom. All the equipment used, including lines and blocks, is small and light in weight. Though about 9 pieces of salvage had to be handled to recover a volume of wood equivalent to one normal pulpwood log, a relatively high production per man-day (145 cu. ft.) was obtained, which is only about 21 per cent. below the 183 cu. ft. of normal pulp-log production per man-day. On the basis of the methods tried, estimates of logging costs are very close to the valuation of the salvage as a source of pulpwood supply, and it seems reasonable to expect that lower logging costs may be obtained through modification of methods and especially in further development of bundling.

The experiment has emphasized that, on account of the small size of much of the salvage: (1) a board-foot scale fails to give an adequate measure of the wood which may be recovered; (2) it is necessary to handle the material with a minimum of operation both in initial recovery and in subsequent conversion; (3) machinery, both in the woods and in conversion plants, must be specially designed or adapted.

Analysis of yarding costs indicates that the costs of this phase of the operation are affected by the quantity of recoverable material. Costs rise with decreasing recovery per acre and it may not be economically possible to salvage some areas with low volume of waste. In order to avoid serious deterioration, salvaging must be undertaken as early as possible, at least within 2 or 3 years of the original logging. While it seems that pulping offers the possibility of fullest utilization, the use of the so-called Swedish gang saws together with the northern European practice of sawing and log sorting to size appears to offer a means of economically converting small material to lumber, which has not been widely realized.

If salvaging is to be generally practised, it is essential that there should be active co-operation between the logger and manufacturer. Whether better utilization may be obtained by pre-logging, by re-logging, or by taking out more material in the first operation, will be determined by the peculiarities of each individual operation.

34.6 : 33.92 : 12.25. FRIEDMAN, L., TOWER, E., and BOALS, R. B. **The effect of storage on Douglas Fir hogged wood and sawdust.** *Res. Leafl. Ore. St. Coll. For. Prod. Lab.* No. 3, 1945. pp. 15. P.R. [1991].

The effect of storage and temperature rise on the heat value and chemical composition of Douglas Fir hogged wood and sawdust has recently been investigated. Maximum temperature was reached in a much shorter time in hogged wood than in sawdust, that for hogged wood being reached in 40–50 days compared with 120–160 days for sawdust. Ten months' storage produced an average loss in dry weight of 7·2 per cent. for hogged wood and 4·2 per cent. for sawdust, which indicates that a small loss in available heat occurred. Calorific determinations, however, did not show any change in heat value per pound dry weight. After ten months' storage the chemical composition, as indicated by lignin determination, showed a significant increase in lignin with a corresponding decrease in holocellulose. Open storage decreased the yield of reducing sugars by about 11 per cent.

35. SALE AND DISPOSAL OF FOREST PRODUCTS. TIMBER TRADE

35 (410). **Home-grown timber.** *Timb. Tr. J.* 175, 1945 (103). [1992].

A memorandum issued by the Ministry of Supply states that of the whole of the timber standing in Great Britain at the outbreak of war (including amenity, shelter and hedgerow timber) about one-third of the hardwood and nearly two-thirds of the softwood had been felled by June, 1945. In the period from September, 1939 to June, 1945, the total quantity of timber produced from home sources (Great Britain and Northern Ireland) in the four main categories of sawn hardwood, sawn softwood, sawn mining timber and round mining timber amounted to 17,400,000 tons. This figure does not include large quantities of poles, timber for wood wool, pulpwood, charcoal, cordwood, firewood, etc. The total home-grown production, September, 1939 to June, 1945, in cu. ft. is shown in the following table:—

	England and Wales	*Scotland*	*Northern Ireland*
Sawn hardwoods . . .	214,400,000	16,500,000	3,500,000
Sawn softwoods . . .	114,100,000	119,600,000	4,700,000
Sawn mining timber . .	42,500,000	59,100,000	nil
Round mining timber . .	179,600,000	92,400,000	1,700,000

35 (43.7) : 94.11. **Czechoslovak timber.** *Timb. Tr. J.* 175, 1945 (372). [1993].

The timber industry in Czechoslovakia has, on the whole, escaped any serious damage during the war. On the other hand, the Germans have exploited the forests ruthlessly, so that the present reserves of timber ripe for felling are much lower than they were before 1939. The total area covered by forests is about 4 million ha., or about one-third of the whole area of the Republic. About 1 million ha. of forest has hitherto been state-owned, but under the nationalization programme, practically the whole of the forested land will become State property. Spruce forms 45 per cent. and Pine 14 per cent. of the forest; of broadleaved species, Beech with 10 per cent., and Oak with 8 per cent. are the most important.

It is difficult to assess the present potential output of the industry, but it must be assumed that it will be considerably below that of the pre-war period, when the annual cut sometimes amounted to as much as 11 million cu.m. In 1939 the industry as a whole employed about 120,000 men, but the figure now is only about 75,000.

A recent decree for the nationalization of Czech factories and works affects the timber industry as a whole; sawmills employing more than 150 men, and plywood and timber-working concerns employing more than 300 men, are to be taken over by the State. The Czech woodworking industry is, however, mostly made up of small concerns, and it is estimated, therefore, that only 20 per cent. of the whole industry will actually be nationalized.

35 (47.0) : 98.3. Zukowski, A. A. **Tomorrow's timber: the role of Russia.** *Wood* 10, 1945 (312–3). [1994].

In the New World the chief conifer forests belong to Canada and the U.S.A.; in the Old World, apart from the Scandinavian forests, they belong to Russia or have come under the control of the Soviet Government as a result of the War. Figures are given showing the marked dependence of West European countries on Russia for the sawn timber so important for reconstruction and the almost complete dependence of their national pulp industries on Soviet and Soviet-controlled forests. While Scandinavian countries are either in or approaching the 'cellulose' stage in the development of their wood industries, Russia and her satellites are still in the sawmill stage, and will, therefore, be able for some time to supply the pulp mills of Western European countries with new material. The northern forests of Russia, which have hitherto been the main source of her exports, are very large, but their area is being diminished by clearings for collective farms, the forests are indifferently stocked, improvident clear felling on a large scale has resulted in natural regeneration of Birch and Aspen rather than Spruce, and the rate of growth in the north is very slow.

35 (59.5 : 410) : 12.26–8 : 98.3. Desch, H. E. **Empire hardwoods.** *Timb. Tr. J.* 175, 1945 (557–8, 673–4). [1995].

The writer illustrates the difficulties involved in building up an export trade for tropical hardwoods, from the vicissitudes of the Malayan timber export trade between 1932 and 1941, during which time it increased from a few hundred cu. ft. to 109,000 cu. ft. He concludes that there are three essential conditions for the success of an export trade with the United Kingdom. These are: adequate supplies, measured in hundreds of cubic tons, not cubic feet, of timber suited to the home market; skilled guidance in the manufacture and grading of timber for a high-quality market; and a local demand for that portion of the outturn that falls below the high standards required by a competitive world market, in practice, anything between 25 and 75 per cent. of the total production, depending on the inherent freedom or otherwise of a species from common defects.

35 (68) : 33.17 : 33.13 : 05.3. South Africa. **Fourth annual report of the South African Lumber Millers' and Shook Manufacturers' Association.** South African Federated Chamber of Industries, 220 Maritime House, Loveday Street, Johannesburg. [1945.] pp. 41. [1996].

In South Africa in 1944 the lumber industry as a whole, including the State sawmills, employed 11,500 people and had an annual output of over £2,766,000, with a wage bill of about £825,000. Total production of shooks, B/T and rough lumber was 48,587 standards or 5,550 more than in 1943. Of the total estimated quantity of sawlogs cut in 1944, i.e. 23,676,353 cu. ft., nearly 7 million cu. ft. went from State plantations to State sawmills and over 10 million to private sawmills, which also received over 6 million cu. ft. from private and native trust plantations. The new forest-products industry is already capable of producing all the Union's shook requirements and 20 per cent. of the pre-war annual imports of rough building timber.

In his address to the Association the chairman reviews the general position and the State policy for forestry, and claims that it is the duty of the forest department to grow trees and leave their utilization to private enterprise. He calculates that the net return for sawlogs supplied to State sawmills is 8·8 pence per cube at roadside as against 10·8 pence obtained from private sawmills. The State has therefore incurred a loss of over £56,700 by using timber in its own mills. These high prices, which are over 250 per cent. of pre-war prices, cannot last. The cost of lumber delivered at mill sites in the Union is 150 per cent. higher than in Canada and the U.S.A. It will not be easy to compete with imports.

35 (71). [Howe, C. D.] **Canada's wood exports.** *Timb. Tr. J.* 176, 1946 (541). [1997].

A statement by the Canadian Minister of Reconstruction on Canadian exports of wood. Figures of production, domestic consumption and exports are given for the years 1934–45. The average percentage of Canada's lumber production exported in the years under review was 48·45. Exports in 1945 will be about 42·0 per cent. of production, which is expected to reach a very high figure.

35 (73) : 33. Greeley, W. B. **Lumber looks out of the foxholes.** *J. For.* 43, 1945 (798–801). [1998].

This address attempts to forecast the future of the American West Coast lumber industry. The author foresees a change from virgin forest to the timber crop as the industry's chief source of raw material; a broader and more varied market for its products, and a very large demand for building materials both in the United States and abroad.

35 (94). Turnbull, R. F. **Timber in Australia in wartime.** *Aust. For.* 9, 1945 (66–9). [1999].

Some striking changes have taken place in timber supply in Australia during the war, as is shown by the following figures:—

Year ending June	*Millions of super. ft. (sawn)*		
	Production	*Imports*	*Exports*
1939	711	324	58
1940	759	261	48
1941	872	97	46
1942	926	60	36
1943	865	32	10
1944	830	45	4

The article gives some account of the distribution of timber between construction, shipbuilding, direct service requirements, industry, and cases and crates.

35 : 76 : 32.8. Bourget, A. Influence de la grosseur des billes et de la classification sur le coût de production et le prix de vente de bois. **[The influence of the size of logs and grading on cost of production and selling price of wood.]** Ministère des Terres et Forêts, Québec. 1945. pp. 16. [F.] [2,000].

A review of various American publications dealing with the cost price of wood, which show (1) that large logs not only give a bigger financial return, but are often the only ones to give a financial return, and (2) that the sale of graded wood is more profitable than that of ungraded.

35 : 76 (77) : 12.26–8. Kellogg, L. F. **Factors affecting wartime prices for Black Walnut stumpage.** *J. For.* 43, 1945 (880–2). [2001].

In the Central States of the United States, stumpage for species in farmwoods has never had generally established market prices. Lack of central markets and wide variations in quality, as well as normal variations in operating costs, contribute to wide variations in stumpage prices. The author analyses some current stumpage price variations for Black Walnut and suggests a possible questionnaire to farm foresters which would provide basic statistics on which to calculate prices. He finds the most significant factors to be grade of log, difficulty of logging, distance to market and volume in the sale.

38. FOREST CONSTRUCTIONAL WORKS. ENGINEERING

38.2. *Building Construction. Foundations and Superstructures*

38.2. **[Special housing number.]** *Timber of Canada* 6 (1), 1945 (51–201). [2002].

This number of *Timber of Canada* is devoted to the housing problem in relation to the timber industry. There are general articles on wood construction, particularly prefabrication of houses; articles on plans for house building in U.S.A., Canada, Great Britain, and Australia; and illustrations, designs and plans of several types of wooden houses.

38.2. **Beautiful homes of wood.** Forestry Commission, New South Wales. 1944. pp. [15]. [2003].

Notes on the general advantages of timber as a building material, illustrated by photographs and small plans of wooden houses in various styles.

38.2 : 31.0 (944). **The flooring timbers of New South Wales.** New South Wales Forestry Commission, Division of Wood Technology, 96 Harrington Street, Sydney. 1942. pp. 48. [2004].

Notes are given on types of floor; specification of wood for flooring; seasoning; laying and finishing of wooden floors. The characters and qualities of the most important floorwoods are described and the board face is illustrated in colour. These are Alpine Ash (*Eucalyptus gigantea*), Blackbutt (*E. pilularis*), Brush Box (*Tristania conferta*), Brush Mahogany (*Geissois benthami*), Crow's Ash (*Flindersia australis*), Luster (*Syncarpia laurifolia*), Spotted Gum (*E. maculata*), Sydney Blue Gum (*E. saligna*), Red Mahogany (*E. resinifera*), Tallow-wood (*E. microcorys*), White Cypress Pine (*Callitris glauca*). Standard trade, common and reference names are listed for 40 species.

38.2 : 31.2. : 33.15. Reece, P. O. **Design of timber structures.** *Timber of Canada* 6 (4), 1945 (57–9, 63–6, 69). [2005].

A review of recent developments in the design of timber structures. The significant developments are: the application of statistical methods to the stress-grading of timber; the utilization of statistical results to provide high working stresses for laminated forms of construction; the development of stable and water-resisting adhesives for the purposes of lamination and to provide highly efficient joints; the use of mechanical timber connectors as an alternative to adhesives; the use of plywood in built-up structural components with particular reference to their application to prefabricated methods of construction; and finally the development of research into the anisotropic behaviour of wood, the characteristic behaviour of a material with a well defined grain.

38.2 : 31.27. Australia. **Council for Scientific and Industrial Research, Division of Forest Products: annual report for the year 1944–45.** Forest Products Laboratory, 69–77 Yarra Bank Road, South Melbourne. 1945. pp. 43. [2006].

Preliminary tests have been carried out on split-ring and shear-plate joints under long-time loading. Tests have shown that split-ring joints with 8-in. end margin fitted with stitch bolts, are liable to fail in less than 3 months when subject to twice the designed load. Tests on split-ring joints in Mountain Ash (*Eucalyptus regnans*) at designed load show about ¼-in. slip after about 7 months, and at half designed load, a slip of 0·14 in. after about 8 months. With Yellow Stringybark (*E. obliqua*) the slip was less. Large-scale tests are to be carried out on both species (p. 20).

38.2 : 31.27 : 31.2 : 33.15.2. Ketchum, V. **Strength of timber.** *Timber of Canada* 5 (11, 12), 1944–45 (33–4, 37–8, 41; 33–4, 37–8, 41); 6 (2), 1945–46 (43–4, 49–50). [2007].

This series of articles is designed to give a clear and condensed account of the strength of timber together with the theoretical principles which enable the data to be intelligently used, for the benefit of engineers who may have to design wooden structures without having a practical knowledge of wood technology. The subjects dealt with include types of wooden members; lumber grades; moisture content and seasoning; service conditions; servicing; decay; preservative treatments; breaking strength; factor of safety; basic stresses; strength ratio; bending; tension; perpendicular and parallel compression; combined axial and perpendicular stresses; horizontal shear; modulus of elasticity; tension perpendicular to grain; close grain; density; form factor; timber connectors, bolts, screws, nails, etc.; glued laminated construction; grading rules; directive stresses; non-stress-grade lumber.

Laboratory technicians now claim that the following statements are true, though the opposite opinion was held for many years:—

(*a*) Kiln-dried and air-dried woods have the same strength for the same moisture content.

(*b*) Virgin-growth and second-growth woods have the same strength for the same density.

(*c*) Timber cut from dead trees has the same strength as that cut from live trees for the same conditions of seasoning.

(*d*) The time of year when timber is cut has little or no effect on durability or strength where equal conditions of seasoning exist.

(*e*) Heartwood and sapwood of equivalent character are of equal strength, and no heartwood requirement need be made when strength alone is the governing factor.

As a result of recent tests, better engineering services and improved construction, American authorities are tending to accept higher stresses for timber and its fastenings.

38.3. *Road and Bridge Construction*

38.3. Hess, E. Generelle Wegnetze. **[General road networks.]** *Schweiz. Z. Forstw.* 96, 1945 (110–22). [G.] [2008].

A review, with reference to Swiss conditions, stressing the general lack of data for practically all factors concerned, of which those needed for calculating financial results are of primary importance and yet so far almost completely neglected. Types of lay-out are discussed and illustrated. It is urged that before marking out roads and deciding on turning places in the field, the suitability of the public road should be considered, all possible solutions for the lay-out of the forest road system should be sketched on the map and a preliminary determination made from the map of the chief obstacles and easy ways. If roads and earth tracks are to be combined the latter should be suitable for later conversion to roads if necessary. Widely divergent views are held on spacing. In the author's opinion 150 m. should be suitable for plains and gentle slopes, 200 m. in the Jura and similar regions, and 300 m. or more for steeper mountain terrain. Curves and the radius of turning places are discussed with reference to length of material to be transported. Pull-ins at every 200–300 m., turning points at every 1,000 m., and loading ramps at every 300–500 m. are recommended. On steep slopes due allowance must be made in road width for the stacking of fuelwood along the edges. Gradients should be 7–9 and not more than 12 per cent. for wheeled transport, and for sledges 15–20 per cent. is believed to be too high. Up-gradients should not exceed 3–4 per cent. for a horse and waggon. On the other hand, gradients of less than 2 per cent. give poor drainage. A final section deals with road density per ha. of forest, which in the author's experience actually varies between 20 and 120 m. per ha. in Swiss forests. Seven Swiss references are quoted.

38.3. Gnägi, H. Zum Thema 'Generelle Wegnetze'. **[Comments on 'General road networks'.]** *Schweiz. Z. Forstw.* 96, 1945 (189–98). [G.] [2009].

Comments in extension of an article by Hess [cf. preceding abstract]. Among practical hints on the surveying of possible road lines, it is recommended that pegging should be left until a considerable section has been approved as the best choice: in the meantime the selected lines are carefully recorded and marked by paint strokes on trees. The procedure is cheap and rapid. As soon as possible after approval of the plan, footpaths should be established along the road lines, especially if road building is likely to be protracted. Costs are discussed for two road-building projects in St. Immer-Tal and tentative figures for the number of km. to be expected for 100,000 Fr. (1944 value) are given as 135·1 of footpath, 10·0 of earth road 2 m. wide, 6·3 of earth road 3 m. wide, 4·3 of earth road 4 m. wide, 2·8 of metalled road 3·3 m. wide, and 2·3 of metalled road 4 m. wide. In addition to the conventional wheeled-vehicle and sledge roads, the author proposes a third type—the 'undeveloped' road for wheeled vehicles, i.e. a cheap road, generally an earth one, which can be converted later into a metalled road if the means become available. Emphasis is laid on the considerable value of roadsides as working places, stacking sites, etc., even where the roads will not bear heavy wheeled traffic. In large, comparatively undeveloped areas where earth roads are used, it would seem best to make relatively small fellings progressing annually. As turning places are costly, only those that are strictly necessary should be made. Smaller radii are required for uphill work, as in this case the ends of logs have more clearance. Stress is laid on the idea of progressive development, e.g. by footpaths and 'undeveloped' roads, on grounds both of the availability of funds and of the possibility of unforeseen developments in the technique of extraction and transport.

38.6. *Drainage*

38.62 (485) : 96. Jungstedt, B. O. Rensningar och kompletteringsarbeten å skogsdikningsfronten. **[Cleaning and supplementary operations on the forest-drainage front.]** *Svenska SkogsvFören. Tidskr.* 44, 1946 (29–48). [Sw.] [2010].

Drainage of unproductive forest land in Sweden was undertaken on an extensive scale after the first world war, at first largely as a means of relieving unemployment. For both State and private forests, drainage operations reached a peak between 1925 and 1935 and have since dwindled to an inconsiderable figure. In Southern Sweden, where the financial prospects of such operations are best, at least 8,000 sq. km. of potentially good forest land remain to be drained. The need for supplementary work and regular cleaning of existing ditches is acute and the bulk of this paper is devoted to examples of neglect and suggestions for improved maintenance and urgent supplementary measures. As the labour market is not likely to be so easy in the present period, drainage operations cannot approach the scale of those previously undertaken, but everything possible should be done to maintain and repair existing drains and to extend the area where drainage will provide good land for forest. In many cases money might be better spent on this object than on the afforestation of essentially poor land.

38.8. *Torrent Training*

38.8. Müller, R. Über die hydraulische Dimensionierung von Absturzbauwerken. **[Hydraulic calculations in connexion with the dimensions of weirs for torrent training.]** *Schweiz. Z. Forstw.* 97, 1946 (41–8). [G.] [2011].

A discussion of calculations in connexion with weir dimensions and their effect on water flow. Designs recommended by the Hydraulics Research Institute of the Swiss Federal Technical College are included.

4. FOREST INJURIES AND PROTECTION

4 (71.4). POMERLEAU, R. **The problems of forest pathology in Quebec.** *For. Chron.* 21, 1945 (267–80). [Division of Forest Pathology, Department of Lands, Quebec.] [2012].

A fairly detailed review of research and literature. The writer concludes by urging the necessity of further research agencies and the training of more forest pathologists.

41. GENERAL PROTECTION AGAINST FOREST INJURIES

41 : 44.3 : 45.3. WILDON, C. E., *et al.* **Control of diseases and insects on ornamental trees.** *Ext. Bull. Mich. St. Coll.* No. 269, 1945. pp. 28. [2013].

42. INJURIES FROM INORGANIC AGENCIES, EXCLUDING FIRE

42 (942). SOUTH AUSTRALIA. **Annual report on the operations of the Woods and Forests Department for the year 1943–44.** Govt. Printer, Adelaide. 1945. pp. 13. [2014].

The effect of spraying with zinc sulphate of areas of unhealthy trees inclined to the disorder known as die-back, has now been under observation for 5 years, and continues to be satisfactory. Early pruning of 'die-back' trees has a temporary beneficial effect, but has to be followed by further pruning within a few years if the first good effect is to endure. However, this mode of treatment, though useful, cannot be compared with the value of the zinc spray, which greatly improves the health and vigour of the treated plantations and materially raises their site quality. The immediate commercial effect of the zinc treatment will be to increase the quantity and value of the pulpwood yield from the first thinnings (p. 10).

42.1. *Air Currents*

42.1 : 22.11. ROTH, C. Windwurf an Rodungssäumen. **[Windthrow on the edges of clearings.]** *Schweiz. Z. Forstw.* 96, 1945 (180–1 + plate). [G.] [2015].

A brief note to accompany two illustrations of windthrow on the edges of clear-felled areas. The damage occurred in spite of the absence of serious storms.

42.2. *Temperature Influences*

42.21 : 60.2. BUSH, R. **Frost and the fruitgrower.** Cassell and Company, Ltd., London, Toronto, Melbourne and Sydney. 1945. pp. viii + 119 + plates. Price 10*s.* 6*d.* [2016].

The maximum variation in the amount of apple crop over a period of 5 years (1932–6) in Australia, U.S.A., Canada, England and Wales was 17, 30, 37·5, and 298 per cent. respectively. This enormous degree of variation in England and Wales is caused almost entirely by the effect of late frosts. The ideal remedy for this state of affairs would be a site survey of the country and the earmarking of good frost-free sites for orchards. In this book, the author confines himself to the practical side of frost in relation to fruitgrowing. Chapters deal clearly with the origin of frost, and behaviour of cold air, the effects of land contours on air drainage, classification of frost areas, nature and indications of frost damage, methods of estimating frost risk and frost intensity, orchard heating, and other methods of frost prevention. Though designed for the fruit grower, there is much to interest and instruct the forester, farmer and gardener. Attention may be drawn particularly to Chapters 9 and 10 on Classification of Frost Areas and Some Frosty and Frost-free Sites, in which a descriptive frost formula is developed for assessing sites by their liability to frost damage. The illustrations, and particularly the numerous, clear diagrams, are of special value.

42.21 (43.1–5) : 12.25 : 12.26–8. SCHWERDTFEGER, F. Ungewöhnliche Spätfrostschäden an Fichte und Kiefer. **[Unusual late frost damage to Spruce and Pine.]** *Forstwiss. Cbl. u. Thar. forstl. Jb.* No. 2, 1944 (115–20). [G.] [2017].

An illustrated account of damage in northern Germany by a late May frost of –6 to –7° C. and probably more severe locally, following warm spring weather. On Spruce that had produced shoots, the latter were turned red, but 10 days later many had already produced fresh green shoots from latent buds in the whorls. In one locality Spruce 1–2 m. high showed damage not only to the new shoots but, as it appeared a week later, to the old needles, and by autumn these plants had lost all their old needles, had only weak new shoots, and might be expected in many cases to die. A Pine thicket about man-high in the same vicinity was severely damaged, though there were striking differences in the resistance of individual trees. The new shoots, already 10–20 cm. long, showed varying degrees of bending or drooping. About 10–20 per cent. of the trees showed discoloration of the older needles about 10 days later. In the beginning of July the stand appeared to be in a miserable condition, but at the end of September new growth had created a superficially normal appearance. Most of the stand is likely to survive but its quality will be considerably impaired as the bent and drooping shoots which remained alive produced crooks and post-horn formations similar to those caused by *Evetria buoliana* and *Caeoma pinitorquum*.

General reports indicate the following differences in susceptibility among common tree species during this frost: Severe damage—Walnut, Oak, Robinia, Red Oak, Ash, Silver Fir. Moderate damage—Beech, Common Alder, Maple, Spruce, Douglas, Larch. Minor damage—Horse Chestnut, Hornbeam, Lime, Grey Alder, Elm, Birch. For the most part no damage—Aspen, Rowan, Bird Cherry, Pine, Weymouth (White) Pine, and Jack Pine.

42.3. *Precipitations*

42.32 (43.7 : 43.8). ROSENFELD, W. Erforschung der Bruchkatastrophen in den Ostschlesischen Beskiden in der Zeit von 1875–1942. **[Investigation of breakage catastrophes in the East Silesian Beskids in the period 1875–1942.]** *Forstwiss. Cbl. u. Thar. forstl. Jb.* No. 1, 1944 (1–31). [G.] [2018].

In the 50,000 ha. of forest formerly known as 'Kammer Teschen', but split up in 1918 between Czechoslovakia and Poland, the total breakage for the period reviewed was 2,017,000 cu.m., of which 1,556,400 was caused by snow and ice breakage, 100,600 by windthrow, 300,000 by a hurricane in 1925 and 60,000 by frost damage in 1928–29. Snow and ice breakage have been greatest in March–May, and next greatest in January–February, only the period June–August being free from this type of damage. 1,115,000 cu.m. of snow and ice breakage occurred in the zone between 500 and 900 m. altitude.

In conifers the larger part of the snow intercepted is carried on the uppermost whorls of the crown. Interception by the three main species, in percentage of total precipitation, varies with age of stand as follows: Spruce—67 at 15 years, increasing to about 75 at 20–35 years, decreasing to 38 at 55 years and then rising slowly to 47 at 80 years. Silver Fir—69 at 15 years, falling steadily with age to 47 at 80 years. Beech—10 at 15 years, increasing to 20 at 40 years and 37 at 50 years, then rapidly dropping to 10 at 60 years. Using these data for Spruce, the most important species, the snow load per ha. and per individual tree are calculated. Owing to a decrease of stems per ha. from 6,000 to 800 between 30 and 80 years of age, the mean snow load per tree increases markedly with age of stand (the load at 80 years being over 450 per cent. of that at 30 years in the instance quoted). Nevertheless the greatest danger to Spruce exists between 20 and 50 years since the branchwood/timber ratio is then greatest and close stocking tends to give, during this period, slender high-crowned trees that are susceptible to breakage.

From the silvicultural point of view the chief means of improving snow resistance lies in measures to avoid asymmetrical and high crowns, and the solution therefore consists in early cleanings and timely crown thinnings to secure a long crown: correct thinning in combination with the provision of a reserve resistant to snow breakage, e.g. in mixed uneven-aged stands, may be expected to improve the soil quality and to favour natural regeneration by increasing flower and fruit production in the open crowns.

From the point of view of management, it is claimed that the yield of plantations in which Spruce predominates, and where climatic hazards exist, cannot be raised unless the stands are made resistant to breakage and windthrow by careful early tending and heavy crown thinnings designed to create a second storey as a reserve against snow breakage. [Cf. *For. Abstr.* 7 (No. 2116).]

42.5. *Chemical Influences. Nutrient Deficiencies*

42.5. GREAT BRITAIN. **Annual report (thirty-second year), 1944: East Malling Research Station, near Maidstone, Kent, 1st January, 1944 to 31st December, 1944.** The Kent Incorporated Society for Promoting Experiments in Horticulture. No. A28, 1945. pp. 137. [2019].

Die-back in Apples and Pears is widespread in eastern and southern England. Analysis shows affected trees to be deficient in potassium, iron and/or manganese, and, in some cases, boron. Preliminary experimental injections of the necessary nutrients in solid form have given encouraging results and further experiments are being made (p. 66).

Deficiencies of trace elements have been diagnosed by painting the leaf surface with a solution containing the elements. An improvement in colour and general appearance was observed in one or two weeks. It is suggested that this is worth further trial as a routine method of diagnosis, especially for trees which do not absorb injected liquid satisfactorily (p. 67).

Thirteen different kinds of plant were grown on a highly calcareous peat to study their relative susceptibility to trace-element deficiency. Willows proved to be highly susceptible to iron deficiency, and the symptoms shown by the Willows were those looked on as typical of manganese deficiency in fruit trees (p. 73).

Curative measures for iron and manganese deficiency are discussed. Injection is recommended when deficiencies are serious, otherwise summer, or possibly winter, sprays (p. 120).

42.51 : 07.2. Mühlsteph, W. Aufgaben der Abgasschädenforschung mit besonderer Rücksicht auf den Wald. [**Tasks of research on industrial waste gases with particular reference to the forest.**] *Abstr.* in *Forstwiss. Cbl. u. Thar. forstl. Jb.* No. 1, 1944 (51–4). [G.] [2020].

A review stressing the great need for further, more systematic work on this problem, and especially for a critical examination of research methods, whether for investigating damage as such, smoke as a locality factor, or measures to abate the production and effects of industrial gases.

42.6. *Electrical and Cosmic Influences*

42.61. Szpor, S. Elektrische Widerstände der Bäume und Blitzgefährdung. [**Electrical resistance of trees and lightning danger.**] *Schweiz. Z. Forstw.* 96, 1945 (209–19). [G.] [2021].

Considerable variation in resistance values was found to exist in individual trees of the same species; such variation was great in Silver Fir, Pine, Spruce, Poplar, Willow, Elm, Robinia, Norway Maple, Horse Chestnut and Ash, but small in Beech and Oak. Particularly wide variation occurred where individual trees showed abnormally low resistance in the lower part of the stem. In Silver Fir and Spruce, abnormality of this type could not be correlated with any other factor, but in Elm, Norway Maple, Horse Chestnut, and possibly Willow, the abnormality appeared most frequently in older trees. Normal trees, however, strongly predominated and showed only moderate variation with position in the stem. The resistance of stem and branches is strongly correlated with temperature, increasing with decreasing temperature, and to this daily and seasonal variations are attributable in part. A provisional table is given of the resistance of common Swiss species in each of the 4 months, April, May, July and September. In the district concerned (Winterthur) the earthing resistance of the trees was relatively very small.

In a discussion of lightning attraction it is concluded that the resistance of the stems can play no considerable part in lightning incidence, and that the earthing resistance is still less important in this respect.

No grounds exist for the belief that a coating of rainwater protects the stem by acting as a lightning conductor. The type of damage caused depends on the course of the discharge: an internal discharge causes phenomena of an explosive nature, while an external one leaves burnt channels only or no clearly recognizable trace at all. Unevenness of the bark impedes the formation of an external discharge and thus leads to serious damage. Secondary discharges to neighbouring trees may occur, especially via branches and branchlets in proximity. The electromagnetic displacement of current (skin effect) is inconsiderable in trees. No support can be given to the notion that damage is caused by evaporation of the sap.

43. FOREST FIRES

43.0. *Predisposing Factors and Causes*

43.0 (74.9). Little, S. **Influence of fuel types on fire danger.** *J. For.* 43, 1945 (744–9). [Northeastern Forest Exp. Sta., Philadelphia, Pa.] [2022].

Local fire danger is now being measured at widely scattered stations throughout the north-eastern United States, and to some extent is being used to determine probable fire loads. These loads vary greatly even within the same area, season, and class of day, and part of this variation arises from the variability in fire danger among local fuel types. Local differences arise largely through variations in stage of vegetation, moisture content of dead fuels, and wind velocity. This paper discusses such variations for the fuel types of southern New Jersey and suggests means of estimating them. For economy of operation the suggested method does not involve sets of stations actually sampling each important type, but the simulation at major stations of conditions prevailing in each type.

43.1. *Protective Measures*

43.1 (79.5). McCulloch, W. F. **Footnote to 'Direct Seeding of Douglas-fir in the Tillamook Burn'.** *J. For.* 43, 1945 (763–4). [Oregon School of Forestry.] [2023].

The first Tillamook burn covered some 245,000 acres in 1933, the second covered about 263,000 acres in 1939, and in late July 1945, when this note was written, a third fire had blackened some 90,000 acres, spotted over a total of 200,000 acres, and was still raging. The first day of this last fire completely destroyed the experimental plots [cf. *For. Abstr.* 7 (Nos. 206, 207)] and many thousands of acres were devastated for the third or fourth time. This area was one of the most productive forest regions in America, and its protection is a matter of serious concern, being complicated by deep canyons, high mountains and millions of dead trees and stumps. The writer argues that cheap reforestation is more than ever an urgent need in the great burn, but that the fundamental problem is how to prevent such fires. Once a fire gets a good start in heavy fuels it will probably only be suppressed when the weather permits. Suppression costs incurred in extinguishing a big fire without the aid of the weather might far exceed the value of the timber eventually to be harvested off the burned area. The expense of absolute complete coverage by lookouts and of firemen stationed closely enough to all parts of an area as broken and inaccessible as the Tillamook region to give assurance that all fires would be caught while still small, would also probably exceed the value of the forest products.

It has been established that this latest fire started in an active logging operation. Many fires do start in this way, which indicates the need for increased vigilance by logging crews. Slash burning and provision of trained fire-fighters and fire-fighting equipment are already covered by the law, but the numerous city-recruited workers in the woods at the present time are not fire-conscious. Intensive training should be given to every logging crew to make the men aware of fire danger. Among the few companies which already do this, fire losses are negligible.

43.1 (941) : 43.0. O'Donnell, J. **Some aspects of fire prevention.** *Aust. For.* 9, 1945 (41–7). [2024].

The programmes of controlled burning carried out before the war ensured reasonable safety from uncontrolled fire in the major hardwood forests of Western Australia, but programmes have fallen in arrears during the war. It is pointed out that the hazards associated with the satisfactory completion of this preventive burning have gradually increased. Areas protected from fire for many years have now developed an accumulation of potential fuel on the ground which, combined with the light inflammable bark of the mature Jarrah, renders the burning of adjacent firebreaks a particularly difficult undertaking. It is apparent that labour resources must for the present be concentrated on the burning of the high-risk railways and roads and boundaries of private properties where most fires occur.

43.1 (945) : 07.7. Incoll, F. S. **Use of radio communication for fire protection.** *Aust. For.* 9, 1945 (29–32). [2025].

The use of radio-telephony in forest communications is discussed with special reference to fire protection. A short description of the equipment used by the Forests Commission of Victoria is given. Defects of the system are discussed, together with its advantages and disadvantages compared with communication by land-line. *Author's summary.*

43.11 : 92 (74.5 : 73). Holst, M. L. **A note on the emasculation of a forest fire law.** With comment by J. P. Kinney. *J. For.* 43, 1945 (877–9). [2026].

The writer of the article suggests that an Act passed by Rhode Island in 1798 was the first complete forest-fire-prevention law in the

United States, but that its effect was weakened by the substituion of the word 'maliciously' for 'wilfully or carelessly' in one section dealing with punishment for starting fires. The writer of the comment cites much earlier legislation on the subject of forest fires, and holds that the laws are better enforced now than in the past.

43.12 : 61.32. Alberta. **Annual report of the Department of Lands and Mines of the Province of Alberta for the fiscal year ended March 31st, 1944.** King's Printer, Edmonton. 1945. pp. 127. [2027].

About 1,500 miles were flown by the Radio Superintendent in aerial reconnaissance of new lookout sites. This method of locating suitable sites for towers has proved very satisfactory. A complete survey can be made from the air, which will give accurate information on the height above sea level, and also above the surrounding land, the extent of visibility in all directions from the selected point, possible lines of easy access to the tower, and finally the exact location of the point for mapping purposes. This information, which can be compiled in the course of a 3 or 4 hours' flight over the desired area, cuts the amount of ground work required to a minimum (p. 35).

43.13 (931) : 07.7. New Zealand. **State Forest Service: annual report of the Director of Forestry for the year ended 31st March, 1945.** Govt. Printer, Wellington. 1945. pp. 35. [2028].

In order that improved fire protection may be afforded to areas of exotic forest, 17 Ford 'Desert Mule' chassis were purchased from the Army Department. These vehicles consist of a short-wheel-base chassis with four-wheel drive, powered by a Ford V8 engine mounted in the rear. The chassis is mounted on 20 × 10·5 in. run-flat shrapnel-proof tyres eminently suitable for traversing rough country. The fire-fighting equipment, which has been specially designed to fit on this chassis, comprises a 400-gallon tank, a high-pressure geared pump, 1,000 ft. of 1½-in. canvas hose with plain and fog nozzles, 30 ft. of suction hose, and two permanent stand pipes for operating a powerful stream of water from both the front and the rear of the vehicle while in motion. The operators, from their position, can cover a complete circle. The vehicle carries a crew of eight, as well as equipment comprising shovels, axes, spades, ropes, picks, 8 Indian knapsack pumps, first-aid equipment, and food. With full load of equipment and water (a total weight of 6¼ tons) it is capable of high speeds over flat country and, owing to its main and auxiliary gears, is also able to negotiate rough surfaces and gradients of 1 in 3 (p. 8).

44. DAMAGE BY HARMFUL PLANTS. VIRUS DISEASES

44.0. *Climbers and Epiphytes*

44.0 (54.87). Ceylon. **Silvicultural Research Administration, 1943.** Typescript. 1945. pp. 14. [2029].

Experiments have been conducted in the eradication or control of *Mikania scandens* in Jak (*Artocarpus integrifolius*) plantations. Branch cuttings of *Gliricidia maculata* planted 2 ft. apart and high-slashed periodically have been eminently successful. This method has provided a very close cover of the ground and has kept sections so treated free from *Mikania* and other climbers. Another useful indigenous leguminous cover-crop species, *Flemingia strobilifera*, has given a dense undergrowth, spreading rapidly beyond the sections in which it had been sown, but although it keeps out *Mikania*, other climbers get through and climb up the Jak trees (p. 9).

44.1. *Forest Weeds*

44.1 : 11.47.2 : 23.13. Kolmodin, G. Klorat i skogsbrukets tjänst. **[Chlorate in the service of forestry.]** Krylbo Tryckeri [?Stockholm.] 1945. pp. 11. [Sw.] [2030].

The chief chlorates suitable as forest weed killers are those of sodium, potassium, and calcium, all of which are readily removed by leaching and converted into the respective chlorides. By the use of such chemicals, competition can be virtually eliminated, the soil benefits by the decay of killed vegetation, especially by the increased supply of nitrogen (which is lost if burning is practised), and decomposition is stimulated by the increased light and air admitted. In regeneration fellings, smaller trees of good quality or selected valuable stems can be left as a shelterwood or as isolated seedbearers and will put on increased increment for some years; chlorate should therefore be used in conjunction with fellings. Owing to the favourable soil conditions created, there may be no need to wait for a full seed year, and a relatively small number of élite seedbearers may produce sufficient ripe cones to stock the site satisfactorily. The use of chlorate is not restricted to pronounced mor soils, but will give good results where grass or other herbaceous growth is troublesome. Romell's experiments at Orsa have shown that magnesium is a powerful moss killer, but excess magnesium will reduce soil productivity. Dolomite [$CaMg(CO_3)_2$] may be combined with chlorate in amounts of 5–10 per cent., but at 20 per cent. reduces the poisonous effect of the latter: such mixtures have the advantages of being less hygroscopic and giving less fire danger.

Chlorates have no considerable 'spread' in the soil and must be applied evenly. Experience at Orsa, where trials have been under way since 1936, suggests the following rates of application (kg. per ha.): (i) For *Calluna*, 20–40; (ii) *Vaccinium* spp. and *Polytrichum*, 80–100; (iii) sphagnum and other mosses, about 100; (iv) Birch, Rowan, Willow, grass and other herbaceous growth, 100–200; (v) ferns 50–200. *Cladonia* is affected little or not at all. Applications are best made in late autumn in moist weather, except for group (iv), which must be treated during the growing season. Vigorous conifer seedlings are not sensitive to the poison, e.g. after an application of 200 kg. per ha., conifer seedlings under ferns (which were killed) lived and throve. Inferior Spruce seedlings invading Pine sites were killed, though Pine seedlings subsequently made good growth. Questions of rates of application, season, etc., are best decided by local trials. Sodium chlorate is the most soluble and probably best for late autumn treatment: potassium or calcium chlorate may, however, be useful where these bases are deficient.

As the compounds are poisonous to man and mammals and, being strong oxidizing agents, introduce the risk of fire, special precautions should be taken. In particular, workers should have special clothing which must be removed on entering cabins or approaching a fire and should not be artificially dried without first rinsing to remove the salt. [Cf. *For. Abstr.* 4 (215); 6 (159); 7 (No. 1403).]

44.1 : 11.47.2 : 23.13. Kloratförsöken i våra skogar. Resultat av en snabbrevidering. **[Chlorate experiments in Swedish forests. Result of a rapid inspection.]** *Svenska SkogsvFören. Tidskr.* 44, 1946 (73–6). [Sw.] [2031].

A tour of inspection was made in summer 1944 by Kolmodin and Romell to compare the results of chlorate treatment in different parts of the country, with special reference to the reaction of the soil (judged chiefly by vigour of ground-vegetation indicator species) on plots in existence for two or more years. Thirty-three plots, in various parts of Sweden and with varied conditions of ground and tree cover, showed a definite improvement of the soil due to chlorate treatment. In almost all of the negative or doubtful cases some other reason (e.g. technically unsuccessful initial treatment, etc.) could be adduced in explanation. The improvement was noticeable in fairly open stands of Pine and Spruce even in the alpine tracts and on areas where many years had elapsed since the last felling, and there was no indication that treatment was less effective in the northern regions. All the indications are that the soil reaction to chlorate treatment is due to the killing of *Calluna*, *Vaccinium*, etc., whereby surviving and newly arriving plants obtain better nutrient supplies owing to reduction of competition and a green-manuring effect. It is emphasized that chlorate alone is a valuable aid, but not the complete answer to the problem of creating the right conditions for regeneration. Many of the plots showed how easily failure could result from improper methods of application or poor storage and handling of the chemical.

44.1 (43.1–5). Pfort, E. Vorläufiges Ergebnis von Unkrautbekämpfungsversuchen mit Natriumchlorat und Anforstan in dem Forstamt Schönlanke. **[Preliminary results of experiments to control weeds with sodium chlorate and Anforstan in the forest district of Schönlanke.]** *Forstarchiv* 20, 1944 (89–102). [G.] [2032].

In tests on sandy soils, from 1935 onwards, equal effectiveness as weed killers was shown by sodium chlorate plus a hygroscopic salt (early abandoned as being troublesome to use with a dry-dusting machine), pure sodium chlorate, and Anforstan, which gives less fire danger than pure sodium chlorate [cf. *For. Abstr.* 3 (21); 4 (125); 6 (140)]. Recommended rates of application, in kg. per ha. and for conditions like those at Schönlanke, are: (i) For *Vaccinium myrtillus* 200, either as a single treatment in September–October or 150 at that time with after-treatment in April of lingering patches with the remaining 50, though, if even distribution is secured, a second application would seldom be needed. (ii) For *V. myrtillus* + *V. vitis-idaea* the same single autumn treatment, increased to 250 where the latter species predominates and followed if necessary by 50 in spring. (iii) For *Calamagrostis epigeios* on open areas, rates up to 600 were mostly unsatisfactory, the poorer results being attributed especially to climate and the dry, porous soil, since better ones have been reported elsewhere with lower rates. The suggested treatment is 200 kg. per sq. m. [?ha.] in autumn and two applications in April, with 14 days' interval and only where live grass appears, each of 100 kg. per sq. m. [?ha.], grass being mowed and removed before the first application. On baulks between planting strips in Pine plantations, treatment of *Calamagrostis* is best limited to cases where the planting strips are raised and the soil is moist: on very dry soils, wettable with difficulty, downpours may wash away the salt. Under shelterwood better results were obtained and the amounts required for control, in kg. per ha., are probably 200 in September–October plus one or two treatments, each of 50–100, in April. (iv) With *Molinia caerulea* the higher the groundwater and the more vigorous the grass, the harder was control. With groundwater deeper than 1·5 m. an autumn treatment with 200 plus a spring treatment of 100 kg. per ha. may effect eradication. For other conditions, results are uncertain.

The possibility of preliminary treatment of Pine planting sites is discussed with special reference to subsequent cultivation and costs (for drier and moister sites, clean cultivation with tractor or horses, and strip cultivation with horse or manual labour). It is concluded that for *Vaccinium* eradication, particularly on the moister sites, the chemical treatment combined with subsequent cultivation would be economical except on dry sites with clean cultivation by tractor. *Calamagrostis* is best chemically eradicated before removal of the old stand, when it is in a suppressed condition; otherwise chemical treatment appears economical with manual strip cultivation and probably with clean horse cultivation, especially where numerous stumps may harbour colonies of grass; possibly also with horse cultivation by strips; but unnecessary with clean tractor cultivation, at all events on land comparatively free from stumps or large stones, where this method is cheapest and most effective. Anforstan may prove to be a means of securing natural regeneration where weeds are the main obstacle. If patches of regeneration are present, care must be taken not to dust any conifers, which are killed by chlorate, but young hardwoods appear not to be injured after reaching 2 years of age.

The use of chlorate in subsequent tending would seldom be needed in plantations on clean-cultivated land. Where strip cultivation has been used, chemical weeding of young stands may be advantageous, with the reservations just made in regard to conifers and those mentioned under (iii). If hardwoods prove as resistant as they now seem, dusting of the planting strips and edges of baulks would be economical and dusting of the whole planting area desirable.

Stress is also laid on the improvement of the physical condition of the soil by chlorate treatments.

44.2. *Parasitic Higher Plants*

44.2 : 12.26–8. De, R. N. ***Loranthus* attack in Sal plantations.** *Indian For.* 71, 1945 (349–50). [Forest Department, Assam.] [2033].

The only method of controlling infestations of *Loranthus* appears to be eradication by lopping. In order to get the best results, the lopping must be completed before the end of December, as it is then that the fruits begin to ripen and are eaten by birds which disperse the seeds. This aspect of control has not been sufficiently realized by those who carry out the lopping, and accounts for delay or failure to control the pest.

44.3. *Fungi*

44.3 : 07.7. König, and Aun, H. Pferdezugspritze zur Schüttebekämpfung. **[Horse-drawn sprayer for controlling leaf-cast.]** *Forstarchiv* 20, 1944 (60–1). [G.] [2034].

Brief description of a sprayer designed by O. Hässler. The machine has 2 pneumatic-tyred wheels adjustable to track widths of 1·6–2 m., a vertical clearance of about 80 cm., a wooden tank of about 250 litres capacity with a pump crank-driven from one of the wheels, and a collapsible spraying tube 5·25 m. long with 12 vents spaced in pairs at 1-m. intervals, capable of spraying 6 rows at a time. In trials, one horse was sufficient except on steep hillsides; 8 ha. could be sprayed in 8 hours working time; and costs per ha. were 5·6 RM. in one case and, owing to trouble with the mixture, 8·75 RM. in another, as against an estimated 9·8 RM. for hand spraying. Better protection of wheel bearings from sand and a higher clearance would be desirable. The use of the sprayer is practically restricted to clean-cultivated areas with straight planting rows.

44.3 : 12.25 : 12.21 (67.6). NATTRASS, R. M. **A canker of *Cupressus macrocarpa* in Kenya caused by *Monochaetia unicornis*.** *E. Afr. agric. J.* 11, 1945 (82 + plate). [Department of Agriculture, Kenya.] [2035].

A note in the *Empire Forestry Journal* of 1944 [see *For. Abstr.* 6 (192)] records the occurrence in Kenya of a canker disease of Monterey Cypress, which resembles a disease caused by *Coryneum cardinale* on the same host in California. Further investigation has revealed on the cankers fructifications of species of *Monochaetia* and *Pestalotia* which have been identified as *M. unicornis* and *P. funerea.* Inoculations of young Cypress trees with cultures of both fungi show that the *Monochaetia* is an active parasite, causing cankers which eventually girdle and kill the tree. No cankers followed inoculation with the *Pestalotia.*

44.3 : 12.25 : 12.21 : 74.2. PETRINI, S. Om granrötans inverkan på avverkningens rotvärde. Specialundersökningar i Lanforsbeståndet 1938 och 1941. **[The influence of Spruce butt rot on the stumpage value of fellings. Special investigations in the Lansfors stand in 1938 and 1941.]** *Medd. Skogsförsöksanst. Stockh.* 34, 1944–45 (327–40). [Sw.g.] [2036].

The Lanfors stand has been maintained with the primary object of elucidating the economic value of natural regeneration of almost pure Spruce, but accurate records have been kept of damage by butt rot in the trees felled. Of the 641 trees felled in 1938 and 1941, 288 (or about 45 per cent.) were more or less damaged by butt rot—probably caused for the greater part by *Fomes annosus.* Fellings in 1941 showed a somewhat higher relative numerical frequency of rot, but whereas in 1938 an average of 3·45 m. per infected stem had to be classed as firewood, the corresponding figure for 1941 fellings was 2·54 m. Most rot occurred in (*a*) large trees over 45 cm. d.b.h. and (*b*) medium dimensions under 30 cm. d.b.h. The percentage diminution of value on the stump, for an equivalent area, was 10·6 in 1938 and 7·7 in 1941. It is to be noted that, in view of the main object of treatment, these figures include quite sound trees felled in accordance with the regeneration programme. Curves are constructed to illustrate the percentage loss of value on the stump, for various diameters, as a function of the percentage of stem length that had to be converted as firewood instead of timber or pulpwood. [Cf. *For. Abstr.* 7 (No. 1407).]

44.3 : 12.25 : 12.21 : 11.43.1 (71.4). GOSSELIN, R. **Studies in *Polystictus circinatus* and its relation to butt rot of Spruce.** *Bull. Serv. for Québec.* No. 10 (*n.s.*), 1944. pp. 44. *Repr.* from *Farlowia* 1, 1944 (525–68). [2037].

The white butt rot of conifers caused by *Polystictus circinatus* has been studied because of its local importance in the province of Quebec and its peculiar behaviour. Field observations were made to try to correlate its occurrence with some ecological factors. The disease was localized in such definite foci of infection that it was thought there might be some connexion with conditions of temperature, insect epidemics, mechanical damage or the chemical nature of the soil. None of these factors, however, appeared to be responsible. On the other hand, the field observations did produce some evidence that this disease penetrated into its host by mycorrhizal association. It was noted, e.g. that infection was from the lateral roots and was apparently not caused by mechanical damage; that on certain poor soils, the growth of rotted trees and the percentage of potassium in their needles were greater than in the case of unrotted trees. The author, accordingly, attempted to establish mycorrhizal relationship between Spruce (*Picea rubra*) seedlings and the fungus, by inoculating seedlings grown in sterile soil with cultures of *Polystictus circinatus.* The relative growth and number of needles of inoculated seedlings measured at 3 months, were significantly greater than those of the uninoculated controls, and while the roots of the latter were often longer, those of the former were characterized by the production of a greater number of secondary rootlets which were frequently branched. Rootlets which, on account of their larger size, were considered to have mycorrhizal relationship, were examined microscopically and it was found that there was a mycorrhizal relationship of the regular type, which was also found in rootlets from a rootlet nest under a sporophore of *P. circinatus* in natural surroundings.

These observations lead the author to conclude that a symbiotic relationship between the tree and the fungus exists until some unfavourable factor, as yet unknown, upsets the balance between the symbionts. When this happens, it seems that the fungus readily becomes parasitic, and the mycelium, instead of remaining intercellular, penetrates into the cells and travels backward along the rootlets, killing them as it proceeds.

44.3 : 12.25 : 12.21 (73) : 12.26–8. Darrow, G. M., Detwiler, S. B., *et al.* **Currants and gooseberries: their culture and relation to White Pine blister rust.** *Fmrs.' Bull. U.S. Dep. Agric.* No. 1398 (slightly revised), 1944. pp. 36. [2038].

Cultivated black currants (*Ribes nigrum*) are more susceptible to White Pine blister rust than any other *Ribes* species, and become heavily infected at great distances from diseased Pines, thus forming fresh foci of infection. The U.S. Department of Agriculture is opposed to the growing of black currant anywhere in the United States, and recommends that State authorities, nurserymen, and growers should take active steps to eliminate it from the Pacific, Rocky Mountain, Atlantic, Appalachian, Ohio Valley, upper Mississippi Valley, and Lake States. The growing of black currants, in private gardens as well as nurseries, should be abandoned throughout these States because of the great importance of the White Pines.

44.3 : 12.26–8 : 12.21. Bavendamm, W. *Valdensia heterodoxa*, ein neuer Buchenschädling. [***Valdensia heterodoxa*, a new pest of Beech.**] *Forstwiss. Cbl. u. Thar. forstl. Jb.* No. 1, 1944 (54–60). [G.] [2039].

This fungus, first described by Peyronel in 1923 as occurring on 14 hosts of widely differing families but for the most part epidemically on *Vaccinium myrtillus*, and subsequently reported on 31 hosts including Beech and other woody species, was identified in the summer of 1943 as the cause of a disease of young Beech sown and planted with Sycamore Maple and Silver Fir as underwood in a heavily thinned Spruce pole wood. In the latter half of June, brown spots appeared on the Beech leaves, gradually extending until whole leaves would turn brown and wilt. There were no other symptoms of damage, but *V. myrtillus* in the neighbourhood showed similar spots. Further observation showed that young Beech in the open, and probably also *V. myrtillus*, were unattacked, and that where Beech was free of infection, so also was the latter species. In the most heavily attacked portion 30–40 per cent. of the Beech was infected. Later, the attack did not appear to be spreading and only a very few Beech lost all their leaves. It thus seems that attack is likely only in the moist conditions within stands and possibly on somewhat weakened plants. Although the damage is not thought serious and precautions (such as removal of *V. myrtillus* or avoidance of planting sites where this species occurs, and destruction of infected leaves) can be taken, the fungus needs watching. Existing knowledge of its characters, distribution and life history is briefly reviewed from accounts by Peyronel and Siemaszko.

44.3 : 12.26–8 : 12.21. Pomerleau, R. L'orme menacé de disparaître. [**The Elm threatened with extinction.**] Service Forestier, Ministère des Terres et Forêts, Quebec. n.d. pp. 7. [F.] [2040].

44.3 : 12.26–8 : 12.21 (71.4). Pomerleau, R. La maladie hollandaise de l'orme au Canada. [**Dutch Elm disease in Canada.**] Extr. from *Rev. canad. Biol.* 4, 1945 (116–8). [F.] [2041].

44.3 : 12.26–8 : 12.21 : 13.2. Canada. **Twenty-fourth annual report of the Canadian Plant Disease Survey, 1944.** Division of Botany and Plant Pathology, Department of Agriculture, Dominion of Canada. 1945. pp. xvii + 122. [2042].

The occurrence of Dutch Elm disease (*Ceratostomella ulmi*) in Canada was established late in 1944 in an area about 40 miles long in the region of Lake St. Peter, Quebec. In the United States, both the European Elm Bark Beetle (*Scolytus multistriatus*) and the native Elm Bark Beetle (*Hylurgopinus rufipes*) act as vectors, but the latter is a much less effective carrier of the fungus than the former. As far as is known at present, only the native Bark Beetle occurs in Quebec, which gives rise to the hope that it may prove possible to eradicate the disease in that province (p. 102)

44.3 : 12.26–8 : 12.21 (74.4). McKenzie, M. A. **Investigation of the Dutch Elm disease in Massachusetts.** *Abstr.* in *Phytopathology* 35, 1945 (656). [American Phytopathological Society.] [2043].

Among the factors handicapping the control of Dutch Elm disease are: (1) the presence of large numbers of 'weed' Elms; (2) prevailing winds favourable to the spread of beetle carriers of the disease; (3) the stacking of Elm in wood piles; (4) storms and other weather conditions resulting in an increased amount of material for beetle breeding; and (5) conditions favourable to the spread of the disease in adjacent areas. Control measures are indicated.

45 DAMAGE BY ANIMALS

45.1. *Mammals*

45.12 (494) : 13.2. Massy, C. Protection contre les dégats du gibier. **[Protection against damage by game.]** *J. for. suisse.* 96, 1945 (235–8). [F.] [2044].

A great increase in the numbers of roedeer in the Jura during recent years has resulted in considerable damage to young plantations of Larch and Scots Pine. The article describes a successful attempt at protection by means of electrified wires. The wires are fixed to small posts and arranged in any convenient manner (for example a fan-shape with many branches, since a closed circuit is not necessary) and electrified by a high-frequency current emitted by an accumulator suspended from a post fixed in the ground. The apparatus used was the 'gardien électrique Lory', which is capable of feeding 3 km. of wire for a period of 1,200 hours. No fresh damage was noted during the experiment. The cost of the installation is moderate: the accumulator costs 260 fr., the wire 3 fr. per 100 m., the insulators 60 ct. each.

45.12 (54.87). Ceylon. **Silvicultural Research Administration, 1943.** Typescript. 1945. pp. 14. [2045].

The Sambhur is probable responsible for more serious and widespread damage than any other pest in plantations. Cypress barked by Sambhur some ten years ago or more, and protected by fencing for the last 8 years, are now being wind-blown in mixed Cypress sample plots. Damage is increasing owing to less poaching and shooting because of scarcity of cartridges (p. 13).

45.12 : 13.2. Aldous, S. E. **A deer browse survey method.** *J. Mammal.* 25, 1944 (130–6). [U.S. Fish and Wildlife Service, Saint Paul, Minn.] B.A.P. [2046].

Description of a simplified method for making a deer-browse survey. Tables are given showing the amount and types of food eaten by deer in three overbrowsed deer yards in Minnesota. Since the amount of any species eaten depends to some extent upon its availability, the food plants which form the greater part of the deer browse in particular areas do not necessarily represent those species for which the deer show greatest preference. Mountain Maple, with a high percentage of availability, constituted the bulk of the food eaten in two of the areas studied, while White Cedar supplied 70 per cent. of the browse in the third area. Among the less available species which were heavily browsed were Mountain Ash, *Viburnum* sp., Red Osier, Red Elder and Honeysuckle.

The Rocky Mountain goat (*Oreamnos americanus* and subspecies) has only recently adopted the Black Hills of South Dakota as its home. During the winter and spring of 1942, observations were carried out by the United States Forest Service on the food preferences of the animal in this area. In the winter period moss and lichens constituted 60 per cent. of the food eaten, Bearberry (*Arctostaphylos uva-ursi*) 20 per cent., and Pine (*Pinus ponderosa*) twigs and needles 10 per cent. The remaining 10 per cent. was made up of miscellaneous plants.

45.12 : 13.2. Lutz, H. J., and Chapman, H. H. **Injuries to young tree trunks from antler rubbing by deer.** *J. Wildlife Mgmt.* 8, 1944 (80–1 + plate). [Yale Univ., Conn.] B.A.P. [2047].

An account of observations made in 1942 and 1943 on injuries caused to trees in the Great Mountain Hemlock/hardwood and mixed hardwood forest in Norfolk and Canaan, Connecticut, by antler rubbing by white-tailed bucks (*Odocoileus virginianus*). A survey of the area in 1943 showed that deer rubbing occurred on about 13 per cent. of nearly 500 quarter-acre plots examined. There was no evidence of distinct preferences for particular tree species. In general, the wounds were at a height of about 20 in. (10 to 36 in.). Although narrow wounds may heal quickly, discoloration of the wood occurs in most cases and decay is occasionally evident. Large wounds heal more slowly and in most cases decay is present, rendering the tree liable to breakage by wind, snow, glazed ice, and other natural agents. Damaged stems can seldom be expected to produce anything but fuelwood or other products of low value.

45.12 : 13.2 : 13.15. BAKER, R. H. **An ecological study of tree squirrels in eastern Texas.** *J. Mammal.* 25, 1944 (8–24). [Texas Game, Fish and Oyster Commission, Austin, Tex.] B.A.P. [2048].

An account of the ecology, life habits, and population fluctuations of the grey squirrel (*Sciurus carolinensis carolinensis*) and the fox squirrel (*Sciurus niger ludovicianus*) in study plots located in Polk and Tyler counties, Texas. The squirrel population was found to be considerably more dense in a mixed bottom-and-hammock plant association than in pure hammock, probably owing to the presence of a more favourable food supply. Food plants included Ironwood, Beech, Black Gum, Oak, Hickory, Pignut, Pecan and Pine.

45.12 : 13.2 : 91.1. RÜEDI, K. Eulenschutz und Mäuseschaden im Walde. **[Protection of owls and mouse damage in the forest.]** *Schweiz. Z. Forstw.* 96, 1945 (123–4). [G.] [2049].

Intensive forestry creates a shortage of hollow trees for owls, which are useful both to agriculture and forestry. Two cases are quoted in which mouse damage to buds of young Silver Fir stopped abruptly when nesting boxes were put up and taken over by owls. In view of mouse damage in nurseries and to young plantations, particularly in grassy sites, it should be worth while to encourage the birds. Advice is given on the siting of nesting boxes.

45.12 : 13.2. CURTIS, J. D. **Appraisal of porcupine damage.** *J. Wildlife Mgmt.* 8, 1944 (88–91). [Univ. of Maine, Orono, Me.] B.A.P. [2050].

Perhaps the most important mammal from the standpoint of injury to forest trees in Maine is the porcupine (*Erethizon* spp.). An attempt is made in this paper to relate the density of the porcupine population to the value of timber losses per acre in forested areas in Maine in which Red Spruce (*Picea rubra*), Balsam Fir (*Abies balsamea*), Norway Pine (*Pinus resinosa*) and White Pine (*Pinus strobus*) are present in saleable quantities. The estimated total losses from porcupine feeding vary from 11·5 to 36 cents per acre. In the present study the method used to calculate loss was the change in log length made necessary by the presence of scars.

45.12 : 13.2 : 13.15. CURTIS, J. D., and KOZICKY, E. L. **Observations on the eastern porcupine.** *J. Mammal.* 25, 1944 (137–46). [Univ. of Maine, Orono, Me.] B.A.P. [2051].

The eastern porcupine (*Erethizon dorsatum dorsatum* L.) is widely distributed in New England, the density of population varying with the terrain and the forest cover. A table is included showing the relative scale of food preferences for north-eastern Maine based on observation only, and without regard to the availability of browse species. Among the trees whose bark is commonly used as food by the eastern porcupine are Red Spruce (*Picea rubra*), American Larch (*Larix laricina*) and Sugar Maple (*Acer saccharum*). The species whose leaves are commonly eaten include Eastern Hemlock (*Tsuga canadensis*), Northern White Cedar (*Thuja occidentalis*), Basswood (*Tilia* spp.), Largetooth Aspen (*Populus grandidentata*), Trembling Aspen (*Populus tremuloides*), Willow (*Salix* spp.), and Black Locust (*Robinia pseudoacacia*).

45.12 : 13.2 (77.4). DICE, L. R. **Some winter foods of the cottontail in Southern Michigan.** *J. Mammal.* 26, 1945 (87–8). [Univ. of Michigan, Ann Arbor, Mich.] B.A.P. [2052].

Cottontail rabbits (*Sylvilagus floridanus mearnsii*) at Ann Arbor, Michigan, fed on fallen pods of Honey Locust (*Gleditsia triacanthos*) during late November, December, and January when they turned their attention to the needles and smaller twigs of young Pines and Spruces, the former species being preferred as a browse. As soon as the snow melted in late winter, however, no further evidence was noted of their feeding on either the Honey Locust pods or the needles of the conifers.

45.12 : 12.25 : 13.2 : 12.19.4 (74). COOK, D. B., and ROBESON, S. B. **Varying hare and forest succession.** *Ecology* 26, 1945 (406–10). [Conservation Department, Albany, N.Y.] [2053].

Observations on a high population of Varying Hare or Snowshoe Rabbit (*Lepus americanus*) on Valcour Island, New York, indicate considerable selectivity in the choice of food. White Pine, Red Pine and White Spruce seedlings less than 4 ft. tall were killed outright; larger trees were trimmed as high as the hares could reach. Balsam Fir and White Cedar were not fed upon. At present, it seems likely that their numbers are kept down in the North-east by certain ecological factors, chief among which may be the lack of low, dense coniferous cover; but the extensive coniferous plantations that have been made throughout the abandoned farmland sections of New England and New York, may materially alter the situation, and the relation of the Varying Hare to forest succession may assume increasing importance.

45.12 : 12.25 : 13.2. MOORE, A. W. **The pocket gopher in relation to Yellow Pine reproduction.** *J. Mammal.* 24, 1943 (271–2). [Fish and Wildlife Service, Hillsboro, Ore.] B.A.P. [2054].

Observations in the Ochoco National Forest, Oregon, indicate that grazing and the presence of pocket gophers (*Thomomys talpoides quadratus*) are responsible for lack of Yellow Pine (*Pinus ponderosa*) reproduction in certain areas. The food of the pocket gopher probably embraces as wide a variety of vegetation as that of any animal and includes the roots, tops and bark of Pines occurring within its range, but there is no indication that the animal consumes naturally disseminated Pine seed. The utilization of pocket gopher runways by seed-eating white-footed mice (*Peromyscus* spp.) appears to be the primary cause of lack of reproduction within the enclosures inhabited by the gophers.

45.3. *Insects*

45.3. STEINHAUS, E. A. **Insect pathology and biological control.** *J. econ. Ent.* 38, 1945 (591–6). [Univ. of California, Berkeley, Calif.] [2055].

The writer discusses the so far rather disappointing results of attempts to control insect pests by means of their disease-producing micro-organisms, and argues that this is probably in a great measure due to lack of fundamental microbiological research. Amongst the questions which need answering are the following:—

(1) How great a factor are diseases in *natural* control of insects?

(2) How can the saturation points of the micro-organisms in a given community be determined or controlled and how can the saturation point for any particular micro-organism and insect be brought about?

(3) Of what importance are diseases occurring in insects which have been weakened by other methods of control?

(4) What part of so-called 'natural mortality' is due to disease?

(5) Do the symbiotes normally associated with insects become pathogenic to their hosts in certain conditions?

(6) Is there any way of predicting outbreaks of epizootics?

(7) Does microbial disease ever prevent the full realization of the success of introduced parasites?

After considering examples of natural epizootics and the artificial distribution of bacterial, fungal and protozoal diseases and viruses the writer remains hopeful that the dissemination of disease organisms under the proper conditions may be helpful, and that, once established, certain diseases may effect a small but significant annual control.

45.3 (47.0) : 13.15. VORONTSOV, A. I. Soveshchanie po biologicheskomu metodu bor'bȳ s vreditelyami lesa. [**Conference on biological methods of controlling forest pests.**] *Priroda* 33 (4), 1944 (82–4). [Russ.] C.G.B. [2056].

Among papers read at a conference organized in February 1944 by the All-Union Forestry Research Institute, one by Modestov stressed the limitations of the liberation of laboratory-reared parasites and the importance of endeavouring to secure a concentration of naturally existing parasites and predators in forest biocoenoses at foci of infestation. A. I. Vorontsov discussed the necessity of investigating optimum conditions separately for separate stages in the development of beetles, and records the successful use of baits (Birch sap, moistened pieces of conifer bark) to attract beetle predators of bark-beetle eggs and larvae; such baits were used in the flight period and their effectiveness was directly dependent on their moisture content. Z. S. Lomakina observed that the larvae of *Acanthocinus aedilis*, which live under the bark of trees infested with bark beetles, competed with and considerably reduced the population of the latter. B. V. Sokanovski discussed the creation of favourable conditions for mass reproduction of tachinids and ichneumons by the cultivation of perennial herbs and shrubs, to be introduced into pure forest stands or waste land destined for afforestation. Such plants, chosen for their nectar production, flowering period coinciding with the flight and feeding period of useful insects, and attractive colours, gave positive results in trials, ridding a number of plots of cockchafer larvae. B. A. Smirnov, working on *Trichogramma pini* for use against *Bupalus piniarius* and *Dendrolimus pini*, found that *T. pini* reared on 'grain moth' was inferior and less active than it should be: new hosts used for this purpose were *Lasiocampa quercus* and 'Oak notodontid'. Rȳvkin, in experiments on the rearing of *Telenomus* on eggs of *Dendrolimus pini* obtained from laboratory-bred specimens of the latter, met with difficulties which suggest that the method is not suitable for mass rearing, and emphasized the need for more research on the ecology of *Telenomus* and its intermediate hosts. Serebrovski suggested that larvae of pests might be caught, artificially infested by tachinids, and released again in foci of infestation. A. V. Tyurin, in a report on Oak stands in the steppe and forest-steppe zones, emphasized the great damage done yearly by *Porthetria dispar* and its associates, the multiplication of which has been favoured by the disappearance of birds owing to the absence of underwood and the felling of suitable nesting trees; aerial control has also destroyed very much of the useful fauna.

45.3 : 13.2 : 13.15. Taylor, W. L. **Forest birds and forest protection.** *Scot. For. J.* 59, 1945 (28–38). [2057].

In spite of very wide gaps in our knowledge, there is ground for belief that a sufficiently numerous bird population, properly balanced in regard to species, may be of considerable advantage in woods and plantations, particularly as insect destroyers. This is supported by published results of experiments in progress for some years before the outbreak of war, at the Forest Research Station at Seebach in Thuringia, where some striking work has been done in the control of insect pests by attracting insect-eating birds in the nesting season. This article summarizes what is known of the effect in British forests of the native bird population. Except the *Columbidae*, practically all forest species include insects in their diet at one time of the year or another. Woodpeckers prey chiefly on bark-haunting insects and their help as a check to the ravages of Elm disease [*Ceratostomella ulmi*] by destroying spore-carrying bark beetles may be more valuable than has been realized. Owls are indispensable as a check to the extreme fecundity of mice and voles. Most of the hawks do not despise beetles and other of the large insects, and nearly half the diet of the much abused Little Owl normally consists of insects including 10 per cent. of weevils. Owls should be given complete protection by foresters. In the interests of agriculture, foresters should not harbour Wood Pigeons; they do no great harm in the woods, except as mast eaters (some have been shot with as many as 100 acorns in their crops), but they do serious damage to green crops.

Suitable nesting accommodation is of the first importance in a forest. The true insectivores nearly all nest close to the floor of the forest among brambles and bushes growing along ride sides and in the more open glades. There is no inducement where the forest floor is bare and the canopy dense; the only remedy is to provide wide rides and to tolerate low-growing minor species, some of which also provide berries and seeds for the seed-eaters. A silviculturally well managed even-aged wood is often a desolate place for small birds and also provides few homes for the hole-nesters. So far as the tits, redstart, nuthatch and robin are concerned, the answer lies in the provision of suitably constructed nesting boxes. Experience in Thuringia points to the need of accommodation for two nesting pairs per acre to secure satisfactory protection against caterpillar attack. The provision of at least three artificial nest places to each acre is necessary to ensure occupation at the correct distribution. Experiments in provision of nesting boxes have been begun in the Forest of Dean [see *For. Abstr.* 6 (260)], and it is intended to experiment systematically on a larger scale in selected areas of the Forestry Commission's forests, both coniferous and broadleaved, in Scotland, England and Wales. [Cf. *For. Abstr.* 7 (No. 1687).]

45.3 (71) : 05.3 : 13.2. Canada. **Annual report of the Forest Insect Survey: Forest insect investigations.** Division of Entomology, Department of Agriculture, Canada. 1944. pp. 70. [2058].

The annual incidence of insect pests in the forests of Canada is determined by means of an extensive and elaborate organization which combines the efforts of the Dominion and Provincial Forest Services, especially the divisions of forest protection and air service, the fire patrol, the division of entomology of the Department of Agriculture, various companies engaged in woods operations and numerous private individuals. Summary reports of the forest insect survey are published by the Division of Entomology, Science Service, for each of six regions, the Maritime Provinces and Newfoundland, Quebec, Ontario, Central Canada, the Agricultural Area of the Prairie Provinces, and for British Columbia with the Rocky Mountain National Parks. In each of these areas a forest insect laboratory is maintained at which reports and collections are received for analysis and identification; over 10,200 separate collections were sent in, the largest contributions going to the laboratories at Duchesnay, Quebec and Sault Ste. Marie, Ontario. The area reports detail the status in 1944 of the major and minor pests of forest and shade trees, with records of localities affected and estimates of the severity of outbreaks for most species. Sixteen maps are provided to show the distribution of collections and reports, and the distribution and degree of infestation of selected major pests.

45.3 : 12.25 : 13.2 (44). Hubault, E. Un parasite non encore signalé des aiguilles du sapin blanc (*Abies alba* Mill.). **[A hitherto unrecorded parasite of the needles of Silver Fir (*Abies alba* Mill.).]** *Bull. biol.* 79, 1945 (17–30 + plates). [F.] [2059].

The writer has made a detailed study of a hitherto unrecorded leaf-miner of young Silver Fir, first noted in the State forest of Ageville (Hte. Marne). A detailed description is given of the stages and life history of the insect, for which he proposes the name *Agevillea abietis*, gen. et sp. nov. Attacked needles first turn yellow and then fall off, and as a result of successive attacks, trees become stunted and bushy. The best preventive of attack is opening up the overhead shade of young trees from the age of 5 or 6 years. A parasite of *A. abietis* (a small species of Hymenoptera) has been discovered and is being studied.

45.3 : 12.25 : 13.2 (71.3 : 71.4). Atwood, C. E. **The status of the Spruce budworm in Ontario and Western Quebec in 1943.** 74th Annual Report of the Entomological Society of Ontario, 1943. 1945. pp. 52–4. O.H. [2060].

The Spruce budworm [*Cacoethes fumiferana*] continued in 1943 to be the most destructive forest insect in western Canada. Heavy mortality resulting from attack by this insect occurred particularly in stands of Balsam Fir. The total amount of Balsam killed or injured beyond recovery probably represents at least one-half of the 25,000,000 cords present in Ontario forests in 1931, while the amount of White Spruce killed probably runs into millions of cords. In some cases the dead Balsam and White Spruce have been blown down, thus reducing the cordage per acre and adding to the difficulties of logging. Further blow-down has occurred, and will occur, among species in mixture with Balsam. Two other bad results of budworm attack are the increased fire hazard and the change in forest composition brought about by the wholesale destruction of Balsam Fir.

45.3 : 12.25 : 13.2 (71). Twinn, C. R. **A summary of insect conditions of importance or special interest in Canada in 1944.** 75th Annual Report of the Entomological Society of Ontario, 1944. 1945 (45–9). [Division of Entomology, Ottawa.] O.H. [2061].

Notes are included on the destructive outbreak of Spruce budworm seriously affecting a large proportion of the Balsam Fir growing in Ontario and Western Quebec, and causing extensive damage to Spruce stands in Manitoba. In British Columbia this insect was the year's most serious defoliator. The Jack Pine budworm also continued to be a major forest pest in Canada in 1944. Economic infestations of the termite *Reticulitermes flavipes* Koll. were discovered for the first time in Canada at Toronto, Ontario, late in 1944.

45.3 : 12.25 : 13.2 (71.3). Leslie, A. P. **DDT in Ontario's forests.** *Canad. geogr. J.* 31, 1945 (187–96). [Research Division, Department of Lands and Forests, Ontario.] O.G. [2062].

The article first gives a general account of the history and properties of DDT, then a general account of the Spruce budworm and a history of outbreaks of this insect in Eastern Canada. At the present time some 13,000 sq. miles of forest in Ontario are heavily infested, medium to heavy infestation covers an additional 25,000 sq. miles, and areas of light infestation are to be found over most of the remainder of Northern Ontario. Pure Balsam stands succumb most readily; Red and White Spruce are often destroyed, especially when in association with Balsam; Black Spruce, while not immune, is rarely damaged. It is estimated that 200 million cords of Balsam and Spruce have been killed in Eastern Canada during the last forty years. The only permanently satisfactory defence against budworm devastation is scientific forest management; with the construction of sufficient permanent roads, employment of increased and expert staffs, timely utilization of older and weaker stands, and wider adoption of the approved methods of silviculture, the budworm may be brought under control. Such a policy, however, cannot be adopted forthwith and the only hope for immediate control of the budworm is by spraying and dusting. The Ontario Department of Lands and Forests has carried out extensive tests of DDT for this purpose and obtained in 1944 useful information on the effects of DDT on various forms of forest life. It was found that the best time to kill larvae is after their emergence from winter quarters and before they enter the Spruce buds.

A more extensive trial was made in 1945. The testing ground selected was a valuable area of 100 sq. miles of infested Spruce and Balsam stands in the Nipigon area. The test was made at the expense of the Ontario Government and all flying was done by the R.C.A.F. in four Canso Amphibians. Fifty-two thousand pounds of DDT were applied, dissolved in as many gallons of coal oil and diesel fuel. Owing to poor flying weather the spraying took more than a month to complete; it was found to be impossible to spray effectively with the wind at a velocity greater than 15 miles per hour. The operation required nearly 300 hours of operational flying. The 64,000 acres to be sprayed were marked on photographic maps in strips for the guidance of the plane crews. This assured completed coverage of the area, since the valves of the spraying devices were opened or closed by the crews as the aeroplanes approached or left a specified area. Spraying plots were also marked, for further assurance of accuracy, by meteorological balloons about 5 ft. in diameter. Final results of this trial are not yet known, but results so far observed are encouraging and suggest a kill of 66 to 70 per cent. and, since DDT keeps its lethal power for a considerable time, the final figure may be much higher.

It is apparent that in DDT and related insecticides we have, if properly used, a powerful ally against insect timber destroyers, which promises almost certain success if infestations can be located and treated in their early stages. This means that forest protection must be advanced to the point where all insect infestations are spotted and reported immediately, as fires are. This service (inaugurated in 1936 by the Forest Insect Survey conducted by the Division of Entomology, Dominion Department of Agriculture, with the co-operation of the field personnel of the provincial forestry departments and the forest industry) has already produced valuable results and will be greatly improved and expanded in the immediate future.

45.3 : 12.25 (729.8). PARKER, R. L. **Report on the survey of the insects and pests attacking the Bermuda cedar.** Bermuda Board of Agriculture, Hamilton. 1945. pp. 5. [Kansas State College.] [2063].

The most important insects found attacking the living Bermuda Cedar (*Juniperus bermudiana*) are the Cedar Looper (*Alcis verrilata*) Cedar Plant Hopper (*Ormenis infuscata*), Black Cedar Scale (*Chrysomphalus agavis*), Gray Cedar Scale (*Lepidosaphes newsteadi*), Juniper Midge (*Contarinia juniperina*), two borers (*Oeme linearis* and *Leptostylus praemorsus*), and various dry-wood termites. Notes are given on life histories and habits. These insect pests could probably all be controlled by oil-emulsion spray. To undertake spraying of the Cedars in the infested areas on the island would be a heavy task and would probably require the use of a new sprayer able to develop a pressure of 500–600 lb./sq. in., and fitted with a forest-spray type of nozzle. Spraying should be done between March and April.

45.3 : 12.25 : 13.2. GRAHAM, A. R. **The establishment of some important parasites of the Larch casebearer, *Haploptilia laricella* Hbn., in Ontario.** 74th Annual Report of the Entomological Society of Ontario, 1943. 1944. pp. 48–52. [Dominion Parasite Laboratory, Belleville, Ont.] O.H. [2064].

After a brief account of the life cycle of the

Larch casebearer (*Haploptilia laricella* Hbn.) in the Belleville district of Ontario, the author lists the native parasite species which have been reared from *H. laricella* since work was started on this insect at Belleville in 1931, and reports recoveries of imported parasites (*Angitia nana*, *Microdus pumilis*, *Dicladocerus westwoodi*, *Chrysocharis laricinellae*, and *Cirrospilus pictus*) liberated between 1934 and 1939. Upwards of 25 native parasites were reared, but never in sufficient numbers to indicate the possibility of their being used for controlling the host. Recoveries were made of all five imported parasites and three of these have been recolonized. It is thought that *M. pumilis* and *C. laricinellae* will become better established and be of more use in casebearer control than the other species.

45.3 : 12.25 : 13.2 (41.1–4). Mackenzie, J. M. D. **Observations on defoliation of Larch by *Orgyia antiqua*.** *Scot. For. J.* 59, 1945 (99–102). [2065].

Notes on defoliation by larvae of *Orgyia antiqua* in July–September of an acre of Hybrid Larch, about 5 years old, in Perthshire. Though every needle of the Larch was eaten, it is considered that leaves of Blaeberry are the primary food, with Larch second and Heather third. Scots Pine seems to be only a starvation diet. From sample counts it is estimated that there were between three and four hundred thousand larvae on an area of about 2,000 sq. yds.

45.3 : 12.25 : 13.2 (71.4) : 05.3. Daviault, L. Nouvelles observations sur la mouche à scie européenne de l'Épinette dans les forêts du nord du St.-Laurent. **[New observations on the European Spruce sawfly in the forests north of the St. Laurence.]** Twenty-eighth Report of the Quebec Society for the Protection of Plants 1936–43. [1944?] pp. 39–43. [F.] [Laboratoire fédéral d' Entomologie, Berthierville.] [2066].

The appearance of the European Spruce Sawfly (*Diprion polytomum*) in Quebec [cf. *For. Abstr.* 3 (253)] was regarded with some alarm, and a close watch has been kept on it. The numbers of the insect have been declining since 1941, principally as a result of a disease attacking the larvae. In case this insect should again prove a serious menace, there is now a good deal of knowledge of its parasites and predators.

45.3 : 12.25 : 13.2 : 32.25.5. Schwerdtfeger, F. Zur Waldgärtner-Bekämpfung durch Schälen. **[On the control of the Pine beetle by barking.]** *Forstarchiv* 20, 1944 (80–1). [G.] [2067].

The life cycle of the two species of Pine beetle (*Myelophilus*) is briefly described. Practical control is limited to that of the young larval broods: pupae and young beetles in the bark can be destroyed only by burning, deep burying or chemical treatment of the bark. Pupation occurs at about the beginning of June, and though second broods are sometimes reared, they are normally of little importance. Freshly felled stems and dying trees are preferred for oviposition, and stems felled before November 1 of the preceding year appear to be unattractive. The practical rule is, therefore, that all stems lying in the woods and felled since November 1 of the previous year must be barked by May 31 (or, in unusually warm weather, by May 15). To save as much as possible of the work of barking, the treatment should be limited to April–May and to such logs as cannot be removed from the forest during this period. These conclusions do not apply if mass reproduction of the beetles is likely.

45.3 : 12.25 : 13.2 (75.5–7). Hoffmann, C. H. **An unusual outbreak of aphids on Pine.** *J. econ. Ent.* 38, 1945 (375–7). [U.S. Bureau of Entomology and Plant Quarantine.] [2068].

Infestation of Pine by aphids (*Cinara* spp.) appears to have no intimate connexion with the little-leaf disease of Pine in South Carolina. An account is given of the distribution of *Cinara* spp. in North Carolina, South Carolina and Virginia in 1944. The occurrence of *Cinara pini* on Virginia Pine (*Pinus virginiana*), of *C. carolina* on Virginia Pine and Slash Pine (*Pinus caribaea*), and of *C. taedae* on Virginia Pine appear to be new host records. Among the natural enemies are two braconids (*Alphidius*, n. sp., and *A. procephali* Ashm.), a cynipid (*Charips* sp.) and syrphid larvae (*Metasyrphus* sp.).

43.3 : 12.25 : 13.2 (77.4 : 77.5 : 77.6). Anderson, R. F. **DDT and other insecticides to control the Saratoga spittle insect of Jack Pine.** *J. econ. Ent.* 38, 1945 (564–6). [U.S. Bureau of Entomology and Plant Quarantine.] [2069].

During the summer of 1944 a study was

undertaken of the Saratoga spittle insect (*Aphrophora saratogensis*) which since 1940 has severely injured many young Pine stands in the Lake States. Results of a preliminary investigation of the use of insecticides are presented. DDT at the rate of 8·3 lb. per 100 gallons of solution was the most promising, as it continued to be effective for several weeks after the trees were sprayed. A mixture of sabadilla and hydrated lime (20 : 80) used as dust was very toxic when freshly applied, but did not retain its toxicity when exposed on the trees. Ordinary hydrated lime and bordeaux were surprisingly effective.

45.3 : 12.25 : 13.2 (485). FORSSLUND, K. H. Något om röda tallstekelns (*Diprion sertifer* Geoffr.) skadegörelse. [**Notes on damage by *Diprion sertifer* Geoffr.**] *Medd. Skogsförsöksanst. Stockh.* 34, 1944–45 (365–90). [Sw.g.] [2070].

D. sertifer is the commonest defoliator and the only one showing frequent mass reproduction in Sweden. As the larvae generally feed only on the older needles, damage is usually confined to a reduction of increment for which few data have been available. The author's measurements of height increment of attacked and non-attacked young Pine trees indicate that heavy larval feeding for one year may reduce increment by about one-quarter of the normal, and such attacks continued for 2 years will effect a reduction of about one-half, at least if all the older needles are destroyed in 2 successive years. A map is given to show the regions where mass reproduction has occurred during the past 25 years, in two grades of severity. The regions of frequent severe attack are all in central and southern Sweden. Several observations in Sweden confirm Schwerdtfeger's claim that the species is unusually resistant to unfavourable meteorological conditions, e.g. in one instance eggs hatched and the larvae developed in spite of a sharp north wind with mixed rain and snow for 3 days at the time of hatching, and in another a fertilized female oviposited normally, laying 92 eggs, in cold rainy weather in the latter half of September. The cessation of a mass attack is generally held to be due to biotic factors. This subject is not examined in detail, but the author has observed larvae of *Chrysopa ventralis* sucking the eggs and those of *Picromerus bidens* sucking the larvae of *D. sertifer*. Though larvae are eaten by birds, and cocoons by shrews, the most important factor in natural control is probably a disease apparently of a virus nature. *Pinus sylvestris* is the normal food plant, but *P. montana* has also been attacked on at least one occasion, and *Picea abies* on several occasions when all available Pine had been eaten. No artificial control has been attempted in Sweden, but control measures might well pay their way for young stands of good quality.

45.3 : 12.25 : 13.2 (469). BAETA NEVES, C. M. La *Dioryctria splendidella* H.S. (Lepidoptera-Pyralidae), espèce nouvelle pour l'entomofauna Portugaise. [***Dioryctria splendidella* H.S. (Lepidoptera-Pyralidae), a species new to the insect fauna of Portugal.**] *Repr.* from *Bull. Soc. portug. Sci. nat.* 14, 1943 (65–9). [F.] [Section Entomologique du Laboratoire de Biologie Forestière, Lisbon.] [2071].

A note on the occurrence in Portugal (first noted in 1940) of *Dioryctria splendidella* as a pest of *Pinus pinaster*. It attacks young Pines in the pole stage, causing resinous nodules on the lower and middle portions of the tree. *Laspeyresia coniferana* occurs on the same species.

45.3 : 12.26–8 : 13.2 : 44.3 : 12.21 (74). SMITH, R. W. **Can samples of American Beech be preserved in Acadia National Park?** *J. For.* 43, 1945 (900–4). [National Park Service, Richmond, Va.] [2072].

The first outbreak of Beech bark disease was recorded in 1920 in Nova Scotia; it has spread considerably in North America and threatens the existence of the American Beech in the North East. The disease is caused by the successive activity of the Beech Scale (*Cryptococcus fagi*) introduced from Europe about 1890, and of *Nectria coccinea* var. *faginata*. In some parts of Acadia National Park, spraying with a mixture of 5 parts of commercial liquid lime sulphur to 95 parts of water is successful but expensive ($45 an acre exclusive of charges for depreciation of equipment). An average of 625 gallons of solution was used per acre. Allowing $5 per acre extra for depreciation, and assuming spraying every 4 or 5 years, a cost of $10–12 per annum is obtained.

A further research project is in hand in connexion with this control programme. Comparison of conditions in protected and unprotected stands will afford a basis for evaluation of the work accomplished and the control plots will also provide information on the probable period of years during which spraying must be continued.

45.3 : 12.26–8 : 13.2 (79.4). Usinger, R. L. **Biology and control of Ash plant bugs in California.** *J. econ. Ent.* 38, 1945 (585–91). [Univ. of California, Davis, Calif.] [2073].

The Ash plant bug (*Neoborus illitus*) is the worst pest of ornamental Ash trees in California. Control with the triethanolamine salt of 2, 4-dinitro-ortho-6-cyclo-hexyl-phenol at 1–400 with 2 per cent. Winter Toxoluble Oil and Vatsol as a wetting agent at 1 to 1,600 was effective (92 per cent. kill) as an ovicide. A mineral oil with oleic acid, a spreader, and rotenone in camphor sassafras oil gave complete control of nymphs and adults at dilutions of of 1 to 400 with blood albumen as a spreader. The oil-rotenone spray should be applied March–April, when the insects are wingless and unable to fly away and avoid the spray. Moreover control at this time prevents oviposition, and thus precludes the development of the next year's generation. *From author's summary.*

45.3 : 12.26–8 : 13.2 (79.4). Michelbacher, A. E. **Control of codling moth on Walnuts: progress report.** *J. econ. Ent.* 38, 1945 (347–55). [Univ. of California, Berkeley.] [2074].

For the control of codling moth (*Carpocapsa pomonella*) in northern California two spray applications are necessary. For best results the first spray should be applied about the first of May while the second can be applied any time about May 18th to the end of June. Standard lead arsenate with a safener was found to be more effective than basic lead arsenate, but further investigation is needed before it can be recommended for general field use. Tests with DDT in 1944 showed much promise.

45.3 : 12.26–8 : 13.2 : 21 (75.6). Berry, F. H. **Effect of site and the Locust borer on plantations of Black Locust in the Duke Forest.** *J. For.* 43, 1945 (751–4). [North-eastern Forest Exp. Sta., Philadelphia, Pa.] [2075].

Black Locust (*Robinia pseudoacacia*) has been much planted in the eastern United States during the last 20 years, usually with poor results. The writer has investigated the plantations in Duke Forest and attributes the result to the use of poor sites and to damage by the Locust borer (*Cyllene robiniae*), the influence of which he analyses in detail. It is clear that in this part of the country Black Locust can be grown to merchantable size only on the better sites. Locust trees are most susceptible to borer attack when they are 1–5 in. d.b.h. Trees of 5 in. or more in diameter usually recover from borer attack. Site quality and degree of infestation are directly related. Slow-growing trees are seldom able to overcome the effects of heavy attack, while fast-growing trees usually recover. There is apparently a direct correlation between the vigour of a tree and the amount of injury. Plantations near to old brood trees are more heavily infested than those at a considerable distance. The Shipmast variety proved no more resistant to injury by the Locust borer than did ordinary Black Locust. Certain silvicultural practices, such as planting Black Locust in mixtures, and coppicing, did not materially lessen the damage caused by the borer.

45.3 : 12.26–8 : 13.2 (71.4). Duncan, J. **A new pest on Black Willow in Quebec.** 74th Annual Report of the Entomological Society of Ontario, 1943. 1944. [Quebec Plant Protection Division, Montreal.] O.H. [2076].

Defoliation of Black Willow (*Salix nigra*) by the chrysomelid *Gastroidea cyanea* Melsh. was reported from the Oka district of Quebec in 1943. Treatment with derris powder (4 per cent. rotenone) gave a fair degree of control. (p. 48).

45.3 : 13.2. Dauberschmidt. Zur Flugzeugbekämpfung des Maikäfers. **[Aeroplane control of cockchafers.]** *Forstwiss. Cbl. u. Thar. forstl. Jb.* No. 1, 1944 (64–8). [G.] [2077].

A large-scale trial of aerial dusting against the field cockchafer was made in 1943 by the Flieger-Forstschutz-verband in the Altmühltal, using Borchess' 'K3' (a dinitro-orthocresol preparation) at rates averaging 100 kg. per ha., the areas selected for treatment being chiefly patches of deciduous woodland on the valley slopes, which were known to be the main swarming places for the beetles, and the intention being to apply the dust at rates sufficient to kill the beetles without serious burning damage to vegetation. A small amount of supplementary treatment of edges of woods, hedges and isolated trees was also done with motor dusting machines, and small areas were treated experimentally with the new insecticides F114 (stomach) and Gesarol (contact) as produced by the Chemische Fabrik Schering, Berlin.

The first beetles appeared on 22 April, but dusting could not be started until 2 May, lasting, with interruptions owing to bad weather, until 12 May. The main swarming areas, ascertained from local report, were treated first. The first mass flight was well covered by the treatment and lapsed after a few days. A second occurred towards the middle of the month, but could not be fully dealt with owing to lack of sufficient insecticide. It was found that slight to moderate air movement gave better distribution of the dust than still air, as after dusting in still conditions the evening flow of cold air gave too much spread into the valley; *ceteris paribus* the morning and evening were equally suitable as dusting periods. As the newly emerging beetles continue to swarm in the same places as their predecessors, it is necessary to continue the dusting of these places at intervals until emergence and flight are completed. It is also necessary to strike rapidly when swarming is in progress, and for these reasons an ample supply of insecticide and sufficient aircraft must be kept in readiness.

The results of the operation were very good except where there was lack of insecticide or interruption by bad weather. An average of 70 per cent. of the beetles is estimated to have been killed before oviposition, and diggings for larvae in the autumn confirmed this success. Damage to vegetation was assessed as very moderate for agricultural crops and small to moderate for trees, being practically confined to burning of Beech foliage, and, to a very small degree, of spring shoots of Spruce. A month after dusting the damage had mostly been made good by fresh growth.

Both of the new insecticides also gave good results and caused no damage to plants or warm-blooded animals. It is noted that Gesarol [cf. *For. Abstr.* 7 (Nos. 1418, 1419)] was used from aircraft at Arzberg, Upper Franconia, in autumn 1943 and gave almost 100-per-cent. control of Pine-looper caterpillars with none of the subsidiary damage caused by cresol compounds.

45.3 : 91.1 : 07.7. **Reports on the effect of DDT and other insecticides on the natural fauna and flora of the forest, methods of application and spraying devices used.** *Res. Rep. Ont. Dep. Lands For.* No. 3, 1945. pp. 53. [2078].

The reports here included were written by specialists of the University of Toronto, the Royal Ontario Museum of Zoology and the Forest Insects Division of the Department of Agriculture at Ottawa. The object of the work was to determine the effectiveness of DDT in controlling Spruce budworm when applied as a spray from aircraft, and the damage done to other forms of life. The work also involved the preparation of a suitable device for application of the spray to ensure maximum atomization without undue drifting.

It is clear from these investigations that there would be little direct injury to mammals and birds, even in large-scale spraying operations; but there is no doubt that insectivores of both groups would suffer indirectly from extensive killing of forest insects. The extent of this injury and the resultant effect on the predators of these animals is at present unknown and can only be assessed by population studies in experimental areas.

Amphibians and reptiles would suffer a heavy death rate as the result of spraying, but the natural fertility and migration of these species would probably enable the population to withstand such a depredation provided it were not too extensive or too often repeated. Fish, with the exception of speckled trout, appeared to be fairly immune to injury. The group of animals which would be most unfavourably affected is the aquatic invertebrate population of the streams. Insect larvae, nymphs and crayfish, the food of stream fish, are practically wiped out by aerial spraying. The damage is done, not only at the point of spraying, but downstream as the spray is carried by the water. It is recommended that, wherever practicable, streams in the area to be sprayed should be marked clearly so that they may be avoided by the pilot of the aircraft spraying DDT. It would also be advisable to exercise considerable care when spraying near lakes in May and June, at which time the fish population, particularly lake trout, is feeding largely on insects from the surface.

It is impossible to predict accurately the indirect and extended effects of the killing over large areas of the forest insects which are the food of many birds, insectivorous mammals, amphibians and fish. This effect and the effect on their predators could only be determined by population studies of experimental areas before and after spraying. Strip spraying, or spraying the edge of an area infected with insect pests should not prove disastrous to the normal fauna of the forest, provided the area sprayed is not too large nor the spraying repeated too often, but even in these conditions it would be wise to make a check on the aquatic and terrestrial fauna of the area.

Details are given of small-scale, hand-sprayer tests and large-scale tests with an autogyro, a White Standard biplane, and an Anson bomber. DDT spray killed all adult moths of Spruce Budworm, but was not effective against the egg stage or the pupal stage. Moths entering the plots and emerging from the pupal stage appeared to have been killed in considerable numbers on coming into contact with DDT residue on the foliage and bark surface.

Twigs of Spruce and Balsam Fir that had been sprayed with a hand atomizer on May 13th and 16th were placed in rearing cages 20 days after application. Healthy budworm larvae were introduced into the cages and, in spite of the fact that the twigs now contained new foliage that had not been sprayed, 100-per-cent. larval mortality occurred in the cages containing Balsam twigs sprayed with 10-per-cent. DDT, and 80-per-cent. in the cages containing Spruce twigs. The effects of DDT were equally powerful on the red-headed Pine sawfly (*Neodiprion lecontei*).

46. DAMAGE BY MAN

46. Fowler, M. E., Gravatt, G. F., and Thompson, A. R. **Reducing damage to trees from construction work.** *Frms.' Bull. U.S. Dep. Agric.* No. 1967, 1945. pp. 26. [2079].

Advance planning is desirable for the tree protection that will be needed in post-war construction of roads and buildings. It would frequently cost less to protect and preserve large and highly desirable trees already growing on an area than to remove them after they die and replace them with smaller and less valuable trees. This pamphlet embodies the instructions which were prepared for the army during the war in order to prevent, lessen or remedy damage to trees from re-grading of ground levels, trenching, re-surfacing, mechanical injuries, overhead clearance, etc.

5. MENSURATION. INCREMENT. YIELD

52. MEASUREMENT OF TREES AND TIMBER

52.3. *Form Classes. Form Factors. Form Quotients*

52.3 : 12.14.4. Prodan, M. Statistische und mechanische Untersuchungen über die Schaftform. **[Statistical and mechanical investigations on stem form.]** *Forstwiss. Cbl. u. Thar. forstl. Jb.* No. 2, 1944 (102–14). [G.] [2080].

A linear relationship was previously demonstrated by the author and K. Krenn [*Mitt. Hermann-Göring-Akad. Forstw.* 8, 1943] to exist—in the main independently of height, species and stand conditions—between the true stem form factor ($\lambda_{0\cdot 9}$) and the form quotient $\eta_{0\cdot 5}\left(=\dfrac{\text{diameter at mid-height}}{\text{diameter at 0·9 of height}}\right)$ This relationship is examined and found to hold good for all theoretically possible stem forms required to satisfy mechanical laws, independently of specific wood properties and crown form. A comparison of values obtained by such theoretical calculations and statistical data obtained in practice shows a fair measure of agreement. As emphasized by Tirén, the differences that exist between theoretical and actual values can be explained only by additional work on crown relationships and the effects of physiological factors. It is concluded from the systematic differences of this nature in partial taper factors for individual portions of the stem that no single stress hypothesis with regard to stem form can be valid for the whole stem. This is especially the case for the upper portion of the stem, and further special investigations are needed.

52.4. *Measurement of Volume*

52.4 : 07.7. Merrill, F. B. **The B-10 tree stick.** *J. For.* 43, 1945 (814–6). [Soil Conservation Service, Minden, La.] [2081].

The measuring stick described in this article was devised by the author in order to make it possible to estimate the volume of logs, trees, or stands in bd. ft., cords, or cu. ft. with a single instrument. The basic consideration in evolving the stick is the basal area of the tree at breast height, or of the log at the top end, expressed in tenths of sq. ft. for each in. of diameter. For clarity and convenience these figures are multiplied by 10, whence the name B-10. When certain factors are applied to these figures, individually or in group totals representing stands of timber, the volume of the log, tree, or stand is given in the desired unit or units of measure. The top edge of the stick is the usual Biltmore scale, and on the top of the front face are the B-10 figures for each in. of diameter. The use of the stick is described in some detail.

52.4 : 52.1. MERRILL, F. B. **Basal area tree and log volumes.** *For. Chron.* 21, 1945 (254–66). [U.S. Soil Conservation Service.] [2082].

A study of basal area with relation to tree and log volumes has developed several practical applications. The method used substitutes basal area breast high (b.a.b.h.) for the conventional d.b.h., but permits recording by d.b.h. classes when desired. A new series of tables has been evolved (specimens of which are printed) which enable quick computation of timber volumes in cords or units of rough or peeled wood and in cu. ft. or bd. ft. The first step was to convert basal area to numbers that could be remembered and used easily and quickly. This was accomplished by multiplying tree basal area in sq. ft. at 4½ ft. above ground by 10 and using the nearest round number to the figure thus obtained.

These numbers are referred to as B-10, and, through a range of diameters, the difference between them and actual basal area is slight. The article describes in some detail the practical use of these B-10 figures in calculating tree and log volumes in various units of measurement.

52.41. MICHAILOFF, I. Über die Genauigkeit der Formeln für sektionsweise Stammkubierung. **[On the accuracy of formulae for sectional volume determination.]** *Forstwiss. Cbl. u. Thar. forstl. Jb.* No. 2, 1944 (120–5). [G.] [2083].

The results of applying 5 different formulae for determining volume by sections (section length varied in this test between ½ and 4 m.) showed that the percentage error varied primarily with formula, secondarily with length of section, and in the third place with species. Smalian's formula almost always gave positive errors: it could be used to give an error of not more than 5 per cent. only if the section length is under ½ m., and with a section length of 2 m. gives mean positive errors of 6–8 per cent. Huber's formula in almost all cases gave negative errors and was relatively very accurate: for 2-m. lengths the mean (negative) errors were Pine 3·12, Spruce 2·26 and Silver Fir 1·84 per cent. Of Hossfeld's formulae one gave generally negative errors, the mean error for lengths of 2 m. being less than −1 per cent.; the other, however, gave positive errors which increased so rapidly with section length that it would give reliable results only with short sections. Ricke's or S. G. Simpson's formula gave positive errors of roughly the same magnitude as the negative ones from Hossfeld's first formula. By species, the percentage errors were greatest for Spruce, intermediate for Silver Fir, and smallest for Pine; the influence of species, however, can safely be disregarded, especially with short sections. It is pointed out in conclusion that Smalian's and Huber's formulae necessitate the measurement of only half as many diameters as do Hossfeld's and Simpson's. Results for a given section length from the former should therefore be compared with those for twice that length from the latter formulae. On this basis Huber's formula has an all-round advantage and should be preferred in practice.

52.43.2 : 01.7. ALMQVIST, G., and HALLMANS, G. Något om olika metoder för inmätning av rundvirke. **[On different methods of scaling round timber.]** *Svenska SkogsvFören. Tidskr.* 43, 1945 (463–78). [Sw.sw.] [2084].

Current scaling methods are discussed. (i) Scaling by top diameter, determining volume in cu. ft. from tables developed in connexion with timber floating, is easy to carry out, especially if the log length is a prescribed one, but produces large systematic errors. (ii) Mid-measurement gives good accuracy, but demands measurement of length in order to fix the mid-point of a log. (iii) Length measurement may be avoidable if both top and butt diameters are taken (in the case of butt logs the latter might have to be taken at 0·5–1 m. from the actual butt). Investigations on a limited scale indicated that this method was as accurate as mid-measurement, but more extensive studies are needed for a definite pronouncement. (iv) Sampling methods have not obtained any general acceptance and there is no generally recognized method of sampling for mean dimensions, though with large quantities of wood there should be little difficulty in achieving sufficient accuracy. The question is largely one of confidence. (v) The top-and-butt method could be simplified by limiting butt measurement to sampling. This should be an improvement on scaling by top diameter, where at present top diameter and length must be measured for every log. From a preliminary calculation it appears that if butt diameter were taken for only 200 logs in a large batch of timber, the resulting error in total volume would exceed 2 per cent. in only 1 case in 100, assuming random sampling. How far this method may be applicable in practice remains for further studies, preferably based on studies of the work of actual measurement, to show. The statistical treatment of the material is detailed in an appendix.

52.43.2 (71.4) : 92. Règlements et instructions du mesurage des bois provenant des terres de la Couronne. **Scaling regulations and instructions for woods cut on Crown lands.** Department of Lands and Forests, Province of Quebec. 1944. pp. 61. [E.F.] [2085].

52.43.3 : 12.25 : 01.7. Stoate, T. N. **The use of a volume equation in Pine stands.** *Aust. For.* 9, 1945 (48–52). [2086].

The Woods and Forests Department of South Australia recently constructed a volume table for *Pinus radiata* showing actual volumes in cu. ft. to 4 in. top diameter under bark for 1-in. d.b.h. and 10-ft. total height classes. The writer of the present article used these data to determine whether multiple linear regression methods could be used with data of this type. A volume equation was developed which gave a reasonably close approximation to the values in the South Australian table and was sufficient to demonstrate the utility of the multiple linear regression method.

The first equation obtained was:—

$$y = \cdot 689723 - \cdot 788606x_1 - \cdot 017126x_2 + \cdot 381124x_3$$

where y = volume under bark to 4 in. top diameter; x_1 = basal area in sq. ft.; x_2 = height in ft.; x_3 is a joint function x_1x_2, that is basal area multiplied by height. It was found that almost as good a fit was obtained by dropping x_1 and x_2 and retaining only the joint function, which gave the equation:—

$$y = - \cdot 36 + \cdot 37x_3.$$

52.43.3 : 12.26–8 (481). Ruden, T. Kubering av bjørk på rot. **[Determination of the standing volume of Birch.]** *Medd. norske Skogforsøksv.* 8 (No. 30), 1944 (517–29). [Nor.g.] [2087].

A provisional volume table and form-factor curves are presented for Norwegian Birch and the statistical accuracy of the results is discussed.

52.43.4 : 01.7. Näslund, M. Antalet provträd och kubikmassans noggrannhet vid stamräkning av skog. **[Number of sample trees and accuracy of volume in complete enumeration of forest.]** *Medd. Skogsförsöksanst. Stockh.* 34, 1944–45 (285–308). [Sw.sw.e.] [2088].

Five chapters deal successively with the chief considerations governing the investigation, the material used, the standard deviation for volume in different diameter gradations, the number of sample trees required for a given magnitude of standard error in stand volume, and the distribution of the sample trees among the diameter gradations. Two tables are given to show the number of sample trees required to obtain standard errors of 1, 2 or 3 per cent. in the volume of sample plots, stands, and tracts marked for cutting, respectively, for conditions similar to those of the stands investigated, taking account only of inaccuracies arising from the fact that sample trees do not exactly represent the material in all respects (i.e. disregarding errors in enumeration itself and in the cubing of individual sample trees), and assuming complete enumeration (of all trees over 10 cm. diameter) in diameter gradations of 2·5 cm. amplitude, sample trees being selected by a constant quotient (every *n*th tree) for all diameter gradations. Distribution of sample trees by a constant quotient is a simple and objective method directly applicable in practice: more strictly, however, it is shown that to achieve the required accuracy with the least possible number of sample trees, these should be distributed among the diameter gradations proportionally as the product of volume and the relative standard deviation for each class. The difference (in sample trees required) between the constant- and the variable-quotient methods is calculated at 12–28 per cent. for a given range of material. As a guide for use with the latter method, certain average series are tabulated for relative standard deviations.

52.43.6 : 07.7. SCHRAMM, W. O. **A shortcut in estimating farmwoods volume.** *Ohio For. News* No. 42, 1945 (31–3). [Ohio Division of Forestry, Wooster, Ohio.] [2089].

An account of an adaptation to Ohio farmwood conditions of the cumulative-volume tally form devised at the Lake States Forest Experiment Station [cf. *For. Abstr.* 4 (195)]. The adapted tally form is designed for 100-per-cent. estimating of small areas instead of one-fifth-acre plots which requires that the acreage of the woods must be known. The volumes are from the original Springfield stick.

52.46 (54.1 : 54.8). GRIFFITH, A. L. **The efficiency of enumerations. V. Upper Assam tropical evergreen forest. VI. Typical calculations.** *Indian For. Leafl.* (*Silviculture*) No. 86, 1945. pp. 12. [2090].

After a description of the area concerned, and the data available, this leaflet compares the errors of partial enumeration in an Assam evergreen forest with those already described in Leaflet No. 84 [see *For. Abstr.* 7 (No. 1432)] for a Madras evergreen forest. The data available for the Assam area are very meagre but are sufficient to show that it is very likely that the tentative indications afforded by the Madras data will apply to Assam evergreens. *From author's summary.*

52.46 : 12.25 (54.5 : 54.2). GRIFFITH, A. L. **The efficiency of enumerations. VIII. Chir** (*Pinus longifolia*) **forest in the Punjab and United Provinces.** *Indian For. Leafl.* (*Silviculture*) No. 88, 1945. pp. 17. [2091].

The data of 13,976 acres of Punjab Chir Pine forest were examined and confirmation was obtained from a small area of 32 acres of United Provinces Chir forest. For practical purposes 5- to 10-per-cent. enumerations are probably sufficient in Chir Pine forest. It was found that, in strip sampling, if each strip is considered in one-tenth-acre plots, by the simple device of closing the books every chain, it is possible, without increasing the work in the field, to increase the precision of the estimate up to a chance of only 1 in 100 that there is an error of over 19 per cent.

52.46. GRIFFITH, A. L. **The efficiency of enumerations. VII, IX. The distribution of the volume figures.** *Indian For. Leafl.* (*Silviculture*) **Nos. 87, 89, 1945. pp. 8, 6. [2092].**

These leaflets give the justification for using certain mathematical methods and applying the normal laws of probability in the examination of the enumeration data which were analysed in Leaflets 84, 85 [see *For. Abstr.* 7 (No. 1432)] and 88. In each case the volume figures were examined and found *not* to be normal distributions. They all showed positive skewness and positive kurtosis, but the extent of departure from normality was not sufficient to vitiate the application of the normal laws of probability. In other words, in the examination of enumeration data for all practical working-plan purposes, it is justifiable to treat the volume figures as normally distributed populations, although in fact they are not actually so distributed. *From author's summary.*

56. INCREMENT

56 : 11.2. WECK, [H.] Beitrag zur Frage: Zuwachsleistung und Witterung. [**Contribution to the question: increment and the weather.**] *Forstwiss. Cbl. u. Thar. forstl. Jb.* No. 1, 1944 (60–4). [G.] [2093].

An investigation of basal-area increment in 86 old (over 140 years) Pine trees at Eberswalde, for the period 1919–38, showed that there was no direct correlation between increment and the precipitation, temperature or hours of sunshine in the year or growing season in which it was produced, neither did combinations of different meteorological data reveal any simple relationship with the increment of the same year. There was, however, a clear relationship between the precipitation of 4 successive years and increment in the last of the 4, and even better correlation existed between precipitation for a series of 4 growing seasons and increment in the last of the 4. Less good, but still fairly close, correlation existed between the ratios precipitation/temperature for 4 growing seasons and increment in the last of the series. The influence of precipitation during the current and 3 preceding growing seasons thus always outweighed those of temperature and hours of sunshine. The results suggest that the influence of precipitation is an indirect one, possibly due to slow, long-term biological changes in the upper soil layers. In connexion with the possibility of influencing forest climates by silvicultural measures, it is estimated that, for the conditions described, a permanent increase of 25 per cent. in available precipitation should give an increase of about 30 per cent. in increment.

Investigations on younger Pine and other conifers remain to be worked up.

56 : 21.6. WECK, H. Kronenausmasse und Zuwachsleistung. **[Crown dimensions and increment production.]** *Forstarchiv* 20, 1944 (73–8). [G.] [2094].

The results of measurements of Pine over 140 years old, growing as reserved selection stems, as standards over young growth, or as marginal trees, and of variously aged Pine, Spruce, Weymouth Pine, Douglas Fir and Sitka Spruce in even-aged [*gleichwüchsig*: (strictly) even-grown] stands were: (i) Size of assimilating crown surface expressed as crown length × maximum breadth was in all cases of primary importance in determining basal-area increment. (ii) The crown/increment ratio showed particularly good correlation in old Pine standards that had become adapted to open conditions. For all species and age gradations in even-aged stands the correlation was much looser: individual differences contribute to this effect, as they do with old standards, but in this instance the causes are to be sought also in variations in the exposure of crowns, either as a whole or partially, and such variations may alter a great deal with time. (iii) Absolute values for the ratio of crown to basal-area increment—i.e. the relative increment production of the crown surface—were different for the different species, but showed no significant correlation with site quality assessed by height. (iv) Under the conditions of even-aged stands, crowns of older Pine stems proved relatively (to crown surface) less efficient than those of young stems. On the other hand, the relative efficiency of old Pine standards with free crowns was very high, exceeding even that of 75- to 90-year-old Pine in even-aged stands. (v) It seems probable that the maximum value for the ratio basal-area increment/crown surface is reached before the maximum crown dimensions are attained.

From these findings it is concluded that conversion to irregular structure offers prospects of permanently increasing the volume increment. It is not yet possible to demonstrate any like increases that might be achieved in even-aged stands purely by thinning practice: the chief means of securing such increases are genotypic improvement either by sowings or by selection during tending, and the fundamental knowledge required for the latter is as yet slight.

56 : 21.6. SCHAEFFER, L. Cime et accroissement. **[Crown and increment.]** *Rev. Eaux For.* 83, 1945 (147–59). [F.] [2095].

The Swiss Federal Institute of Forest Research has, for the last 20 years, been carrying out detailed investigations on the crowns of trees and their relation to increment, and this article reviews some of the results of these researches [cf. *For. Abstr.* 1 (267, 300–1)], which have been made chiefly on Spruce and Beech.

Crown length: In a young stand of Spruce, crown length represents roughly 40–50 per cent. of the total height of the tree, while the proportion declines to between 30 and 40 per cent. in stands 80 years old and more. There are, however, considerable differences between trees in the dominant and dominated storeys, the length of crown in the former being both relatively and absolutely greater. The length of crown is increased by intensive thinning.

Form and apparent volume of the crown: The volume of crowns per ha. in a pure Spruce stand has been estimated as 42,000 cu.m. at 35 years of age, and 54,000 at 98 years. In a 132-year-old stand which had been lightly thinned, the volume decreased to 48,000 cu.m. In uneven-aged Spruce stands it has been found that 62 to 66 per cent. of the crown volume is represented by the sun crown (i.e. that part of the crown above its greatest width), but in a stand which had formerly suffered borer damage, the sun crown amounted to only 44 per cent. of the whole crown.

Leaf surface and needle weight: It has been calculated that the surface area of a needle of Weymouth Pine is 0·7–1·4 sq. cm., of Douglas Fir 0·3–0·6 sq. cm., of Spruce 0·3–0·5 sq. cm. and of Silver Fir 0·6–0·9 sq. cm. Spruce needles from the sun crown weigh 120,000 to the kilogram, those from the shade crown 150,000. The area of leaf surface per hectare for 35- to 40-year-old Spruce is 190,000–220,000 sq. m., for 98-year-old Spruce 180,000 sq. m., for partly thinned 132-year-old Spruce, 88,000 sq. m. The figures for Douglas Fir are higher: 184,000 sq. m. at 20 years, 252,000 sq. m. at 36 years, and 271,000 sq. m. at 41 years.

Needle weight and increment: Careful measurements have been made to determine the relation which exists between weight of needles and increment. The results vary with species, age of trees, and provenance. Weymouth Pine (*Pinus strobus*) requires a fresh-needle weight of 1,000–1,100 kg. to produce 1 cu.m. of stemwood; Douglas Fir 1,300 kg.; a close stand of 98-year-old Spruce 2,100 kg. and an open stand of 132-year-old Spruce 1,750 kg. Great differences were noticed in plantations of 25- to 27-year-old Scots Pine according to the provenance: 700–800 kg. for races from South Germany and 1,100–1,200 for Norwegian races. The figure for 80-year-old Beech was 800 kg.

Transpiration by leaves: The amount of water transpired by leaves was calculated many years ago by von Höhnel, who determined 'transpiration coefficients' for the principal species, which indicate the weight of water transpired annually by a kg. of needles; e.g. that 1 kg. of Spruce needles (weighed in the dry state) transpires 165 kg. of water in a year. Burger, basing his calculations on these figures, estimated the water transpired by a 35-year-old stand of Spruce or Beech to be the equivalent of a rainfall of 250 mm. per year.

Spacing: In theoretical studies of management in France, use is often made of the ratio D/d where D = diameter of the crown at its level of greatest width and d = diameter of stem at breast height. Thus the spacing of Firs in a fully stocked stand has been based on the formula D = 10d + 1 metre, and the normal spacing of high, open forest based on measurements made in coppice with standards has been calculated from the formula D = 20d + 1·50 m.

It has been calculated that a tree covers an area equal to the square of a diameter, and the following values have been assigned to that diameter: for Spruce one-sixth of the total height, for Beech one-fifth or two-ninths of the total height. In fact, the use of these formulae arrives at figures which are a little too high, but they provide a simple means of calculating the possible number of stems in a stand.

Thinning: It has long been known that thinning in the upper storey is not applicable to Spruce. Studies on crown development confirm and explain this view. At a certain age there is established a lower level for the crown, which is the same for all trees in the stand, whatever their size, so that only the dominant trees have a great length of crown. The dominated trees, having no green branches at levels as low, in proportion to crown length, as those of dominants, react less efficiently to thinning.

56 : 21.6 : 12.11 : 11.44. Møller, C. M. Untersuchungen über Laubmenge, Stoffverlust und Stoffproduktion des Waldes. **[Investigations on foliage quantity, losses and production of materials in the forest.]** *Forstl. Forsøgsv. Danm.* 17, 1945 (1–287 + tbls.). [G.dan.] [2096].

Fifty-eight pages are devoted to a review of literature, which serves to emphasize the considerable gaps in detailed knowledge of the turnover of materials during the life of a stand. The chief results of the author's own investigations were: (i) *Quantity of foliage* (*Beech*)—For Danish site qualities 1–4, site quality had no demonstrable effect on leaf area or dry leaf weight per ha. There was a slight tendency for individual leaf area, but not thickness, to decrease with decreasing site quality. The influence of age and height was small: the leaf area of stands, attaining values near to maximum with the first closure of canopy, showed relatively small increases (10–20 per cent.) between 20 and 120 years, with probably a slight simultaneous reduction in individual leaf area but not in thickness. Leaf weight and area per ha. could be practically constant under widely varying grades of thinning, and these influenced neither individual leaf area nor thickness. During the period of observation, climate had only small effects, though it appears that leaf area is greatest and leaf thickness smallest in rainy, rather cold years with little sunshine. There can be no direct correlation between (*a*) leaf quantity per ha. and (*b*) height and volume increment, as the former remained almost constant through different site qualities and varied little with age, whereas the two latter are strongly influenced by these factors. Although both (*a*) and (*b*) are temporarily reduced by thinning, the reduction is rapidly made good. Basal-area increment of Beech, at least in Denmark, is practically unaffected by grade of thinning or site quality. The mean leaf area (one surface) and dry leaf weight per sq. m. of stand were respectively about 5·5 sq. m. and 250 g. (ii) *Quantity of foliage* (*Norway Spruce*)—The relations between quantity of foliage per ha. and needle size on the one hand, and site quality, age, thinning grades and increment on the other, were in essential agreement with those for Beech. Wood increment per unit needle weight increased in inverse proportion to the ratio needle weight/wood volume, i.e. in the mostly heavily thinned stands sampled, needles were most efficient on trees with relatively the smallest needle quantity. The mean needle area and dry needle weight per sq. m. of stand were 13·1 sq. m. and 1·2 kg. respectively. (iii) *Quantity of foliage (other spp.)*—Measurements of three 40-year-old Oak stands gave a leaf area (one surface) per sq. m. of stand of about 3 sq. m. and a leaf weight two-thirds to three-quarters that of Beech. The basal-area increment of upper-storey trees was the same for 3 thinning grades. Values for individual trees of Beech, Oak, Birch and Larch show mainly the great difficulty of relating such figures to those for whole stands. (iv) *Losses of material in fallen branches*—On the basis of yield tables and various measurements the formula developed for rough losses over a period is $A = 0{\cdot}5\ M\ (1-K)$, where M = volume and K = crown ratio. (v) *Root losses*—From practical experience and physiological considerations it is estimated that these must be at least as great as branch losses over an equivalent period. (vi) *Bark losses*—Though no reliable figures exist, these, even for thick-barked species, can be only a small fraction of branch or root losses. (vii) *Xylem respiration*—From a reconsideration of existing data it is concluded that this, particularly in species with much heartwood, will be concentrated near the outer surface and will thus be chiefly a function of surface area. (ix) From the data obtained, tentative 'production spectra' are constructed for Beech, Spruce and Ash, showing graphically: total apparent assimilation; respiration losses throughout the woody body; leaf, branch and root losses; and wood increment above and below ground level (all in tons of dry substance per ha. and year).

In discussion it is pointed out that the great constancy of foliage quantity in different stands of the same species indicates that a species tends to use available light to the limit of its capacity, independently of site quality, etc. The relation of the findings to the curves of the various kinds of increment is discussed at some length. As regards litter and surface humus accumulation on poor sites it is suggested that if the decomposition capacity of the soil increases with site quality approximately as the increase in the yield capacity of the forest, the constancy of foliage quantity under these varying conditions would be directly reflected in the degree of humus accumulation. Thinning and the relations of the light-demanding and shade-bearing species are also considered.

56 : 21.6 : 12.25 : 12.11. LADEFOGED, K. De enkelte Krondeles produktionsmæssige Betydning hos Rødgran. **[The importance of individual parts of the crown, in Norway Spruce, from the point of view of increment production.]** *Forstl. Forsøgsv. Danm.* 16, 1946 (365–400). [Dan.e.] [2097].

The results are presented of a study of height, basal-area and volume increment over a 5-year period of young Norway Spruce (21 years old at the beginning of the treatment) in which, initially by removing up to 7 whorls of branches and subsequently by removing 1 whorl after each growing season, the whorls per tree were kept constant at numbers varying between 4 and 14 for individual trees. The results were: (i) Height increment was relatively little affected by reduction of the crown, whereas there was a distinct positive correlation between basal-area increment and the number of whorls present. Both height and basal-area increment, however, showed much individual and irregular variation. (ii) Volume increment increased proportionally with increasing crown size within the uppermost two-thirds of the crown reckoned by number of whorls or three-quarters reckoned by dry needle weight. The remaining lower portion produced only about 15 per cent. of the volume increment of the stem. (iii) Calculations, made on the basis of Stålfelt's assimilation curves and determinations of needle quantity for each whorl and each year, suggest that the greater part of total assimilation occurs in needles of the last two years', and more than half in those of the last year's growth, and that in crowns of 9–11 whorls half of the total assimilation takes place in the topmost 4–5 whorls. [Cf. *For. Abstr.* 7 (No. 1791).]

56 : 31.1 : 01.7. RUDEN, T. En vurdering av anvendte arbeidsmetoder innen trekronologi og årringanalyse. **[An evaluation of methods used in dendrochronology and annual-ring analyses.]** *Medd. norske Skogforsøksv.* 9 (No. 32), 1945 (181–267). [Nor.e.] [2098].

An introductory section deals with the applications of statistical annual-ring analyses in forest mensurational studies, the relation of climate and tree growth, and the dating of woody remains, etc. In Section 2, which deals with the actual measurement of rings, the apparatus described by Näslund [cf. *For. Abstr.* 7 (No. 1805)] is recommended, and a method is reported of rendering rings of Birch and other hardwoods more evident, the procedure being as follows: the increment core is soaked for a few hours in aqueous glycerine, fixed in a special frame, cut to give a smooth surface, painted with a water-colour (e.g. chrome green) in glycerine, cut again to expose a clean surface, and measured under a magnification of about 20× by transmitted light. The method colours lumina and intercellular spaces, leaving cell walls uncoloured and translucent; it is not, however, suitable for decayed wood. After measurement, a check must be made for miscounts by comparison of curves for different series, matching being simplest if these are plotted on logarithmic scales. Section 3 is devoted to the preliminary elaboration of the material, with subsections on correction for age effects and the computation of means, with special reference to the use of geometric means and of regression analysis to obtain corrected index values for the terms of the series to be combined. A further section is devoted to an examination of statistical significance in dendrochronological datings, with a consideration of refinements necessary for the evaluation of significance when a small series must be used.

56.02 : 07.7. Christiansen, E. Jägmästare G. Ulléns Tilvæksthammer. **[Ullén's increment hammer.]** *Dansk Skovforen. Tidsskr.* 30, 1945 (509–11). [Dan.] [2099].

Consists of a tubular handle with a hollow, spherical head into which is screwed a thin steel pipe that replaces the usual increment borer, with a steel rod for ejecting the core. There is a scale on the handle for rapid measurement. The stroke must be made vertically, a knack that is readily acquired; one or two twists then suffice to free the instrument, which is quick and easy to use. The cutting pipe is not considered long enough to take 5 annual rings of Spruce as grown in Denmark, and for thick-barked species a preliminary removal of some bark would be necessary. A collapsible model for the pocket is suggested, with a longer cutting pipe. Though the instrument is not patented in Denmark, it can be produced more cheaply in Sweden (by Firma Skoginstrument, Mora).

56.02 : 12.25 (949). Australia. **Annual report of the Commonwealth Forestry Bureau for year 1944.** Govt. Printer, Canberra. 1944. pp. 15. [2100].

The study of the growth of Monterey Pine (*Pinus radiata*) was continued. The mean annual girth increment of thinned trees was 15·53 mm. and of unthinned controls 6·48 mm. The experiment of cutting the surface roots showed a highly significant result. The mean annual girth increment for the untreated trees was 7·95 mm. and for the treated ones 2·05 mm.

56.05. Hedman, A. Några synpunkter på vardetillväxten. **[Some points of view on value increment.]** *Skogen* 33, 1946 (25–6). [Sw.] [2101].

A plea is made for studies of value increment with a view to the possible compilation of practical tables for the better assessment of the results of tending operations.

56.1 : 12.26–8 (946). Helms, A. D. **A giant Eucalypt (*Eucalyptus regnans*): Nichols Spur, Junee, Derwent Valley, Tasmania. 1548 A.D. 1942 A.D.** *Aust. For.* 9, 1945 (25–8 + plates). [2102].

An account of a tree felled in Tasmania in 1942. The height of the tree was 257 ft. (probably 300 ft. before crown was broken), girth at breast height 65 ft., total merchantable volume 63,780 super. ft. Measurements made of diameter increment based on the average ring counts and measurements of 2 radii at the top end of the first 20-ft. log (35 ft. from the ground) show that the year of germination was about A.D. 1548. A study of the current and mean annual figures shows a remarkably constant vigour over a very long period of years, and only in the last 40–50 years did growth fall off. One of the largest trees of *E. regnans* recently measured in Victoria was 332 ft. high but only yielded 23,000. super. ft.

56.2 : 01.7. Petrini, S. Kritisk granskning av metoder för beräkning av skogens massatillväxt. **[Critical review of methods of calculating the volume increment of forest.]** *Svenska SkogsvFören. Tidskr.* 44, 1946 (49–59). [Sw.f.] [2103].

The varying use of initial, mean, or final growing stock in formulae for the mean annual increment per cent., results in considerable differences in the values obtained. Five formulae are discussed, of which the first two, based respectively on initial and final growing stock, give very different results and are considered unsuitable, whereas the remainder, all based on compound interest (Pressler's formula, compound-interest formula, and that for the absolute increment per cent.), give less divergent values. The most suitable appears to be $1{\cdot}0p^n = \frac{m_n}{m_o}$, where m_o = initial, and m_n = final growing stock for the period n. Its advantages are that compound interest is used in all economic calculations and tables are available for $1{\cdot}0p^n$, from which p can be read off direct; that the error is in all probability less than one digit in the first decimal place; and that it facilitates further computations. Either the difference in total volume may be taken, or that in individual factors may be separately calculated and combined later. In the latter case, e.g. if basal-area (p_1) and form-height (p_2) increments per cent. are separately calculated, only the values given by the formula for absolute increment per cent. can be combined by simple addition: with Pressler's formula such combination should be effected by the formula $p = \frac{p_1 + p_2}{1 + \left(\frac{n}{200}\right)^2 \cdot p_1 \cdot p_2}$, and for values obtained with the compound-interest formula quoted above, it is convenient to employ the term $1{\cdot}0p$ throughout, when it can be shown that $1{\cdot}0p = 1{\cdot}0p_1 \cdot 1{\cdot}0p_2$, and p is readily obtained as the combined value.

For calculating mean increment per cent. over a period in which fellings have been made the appropriate compound-interest formula is $[(m_o\ 1{\cdot}0p^{n_1} - a_1)\ 1{\cdot}0p^{n_2}] \cdot 1{\cdot}0p^{n_3} = m_n$, where n = years in period, a_1 = volume felled after n_1 years; a_2 = fellings after a further n_2 years, etc. This equation must be solved by successive approximation and preferably graphically by plotting m_n as a straight line and constructing a curve for values of the left-hand term with trial values of p, the intersection then giving the required value. Some attention is given to similar calculations with the other formulae, to determination of absolute increment per cent. where m_o is unknown, and to increment for future périods. Special problems are here involved and the treatment is preliminary only.

56.2 (77.1) : 22.88.2. LEETE, B. E. **How fast does second-growth timber grow?** *Ohio For. News* No. 42, 1945 (35–8). [Ohio Division of Forestry, Chillicothe, Ohio.] [2104].

In 1922 the Ohio Agricultural Experiment Station purchased a tract of cut-over land which had been burnt every year since logging. It then consisted of irregular groups of Shortleaf and Pitch Pine with hardwood wolf trees overtopping a dense undergrowth of hardwood saplings. In 1924–5 a 10-per-cent. cruise of the growing stock was made, all trees 6 in. and over in d.b.h. being measured. In addition, all saplings 2 in. and over in diameter on one side of the baseline were measured. Trees 12 in. and over were tallied in diameter, and merchantable length taken in terms of 16-ft. logs and half logs. About 10 years after the survey, C.C.C. crews made salvage cuttings of Chestnut, cut many wolf trees, and released the White Oak, which was being crowded and dominated by the relatively inferior Scarlet Oak.

In 1944 a 10-per-cent. tally was made in the same manner as the original cruise. A comparison of basal area for all species in 1924 with that of 1944 shows an increase of 108 per cent., from 34·77 sq. ft. to 72·52 sq. ft., or a gain of 37·75 sq. ft. per acre. Analysis of the results by species shows that the composition of the stand is altering in favour of Oaks at the expense of Pines, which is attributed to the exclusion of fire. There is now 10 times as much merchantable volume in trees 12 in. d.b.h. and above as there was 20 years ago. The rate of growth of trees 12 in. d.b.h. and above is 67 bd. ft. per acre per year.

57. DEVELOPMENT AND STRUCTURE OF STANDS. YIELD

57 : 12.25 : 21.0 (489). ELMQUIST, A. G. Ekskursion til Langesø Skovdistrikt den 18 Oktober 1945. **[Excursion to the Langesø Forest District, 18 October, 1945.]** *Dansk Skovforen. Tidsskr.* 30, 1945 (518–28). [Dan.] [2105].

Includes brief notes on the growth of some exotic conifers (*Pseudotsuga*, *Thuja plicata*, *Chamaecyparis lawsoniana*, *Abies grandis*, *A. concolor*, *Tsuga heterophylla* and *Sequoia gigantea*) in this district of Denmark.

57 : 12.25 : 31.0. GERASIMOVA, M. V. Kavkazkaya pikhta i eë interesnȳ obrazets. **[*Abies nordmanniana* and an interesting specimen of this species.]** *Priroda* 33 (4), 1944 (95–6). [Russ.] C.G.B. [2106].

Abies nordmanniana is one of the tallest and most productive trees in the U.S.S.R. In the best stands aged 250–300 years the growing stock is as much as 1,500 cu.m. per ha. Individual trees are over 50 m. high, 1·60 metres in diameter and yield 45 cu.m. of timber. The species grows on Caucasian mountains at altitudes of 700–2,200 m. Its wood is used for aircraft, musical instruments, large sawtimber, and locally for roof shingles. The bark contains 10 per cent. of tannins, and the twigs might be used as a raw material for obtaining camphor. Apart from its direct products it is an important species in protection forests.

An exceptional tree, samples of which were sent to Moscow for mensurational study, was 50·4 m. high with a butt diameter of 136 cm. and a d.b.h. of 106 cm. at 178 years of age: this represents exceptional increment, as the species usually reaches such dimensions only at 400 years.

57 : 12.25 (79.6). MILES, C. **Growth of Ponderosa Pine by Keen tree class.** *J. For.* 43, 1945 (905–7). [U.S. Forest Service, Ogden, Utah.] [2107].

The author presents and analyses sample-plot data from the Boise and Salmon National Forests in support of his contention that the Keen tree classification provides a reliable guide for the marking of Ponderosa Pine stands in south-western Idaho. The rule is to leave classes 1, 2, 3A, 3B trees, and class 4A if needed for seed or to fill openings. The evidence indicates that class 3C and 4 trees are poor risks, and that, of the two, the class 4 tree with the A crown is the better.

57 : 12.26–8 (485) : 23.2 : 23.5 : 63. PETRINI, S. Tre försöksytor i aspskog. **[Three sample plots in Aspen woods.]** *Medd. Skogsförsöksanst. Stockh.* 34, 1944–45 (309–25). [Sw.sw.e.] [2108].

Data are furnished on the soil, vegetation and growth of 3 sample plots in almost pure Aspen (*Populus tremula*) in Västergötland. The stands, now nearing the end of the normal Aspen rotation, i.e. about 60 years, are among the best in Sweden. The 'thinning index' (*gallringsindex*), derived from the relation between percentage of trees and percentage of volume removed in thinnings, was mostly greater than unity, indicating that the method used has been chiefly low thinning. Results show that at the end of a 60-year rotation on such sites the stems per ha. should be 300–400 and preferably nearer the latter figure, the volume standing for final cutting about 260 cu.m., and the total intermediate yield about 240 cu.m., per ha. The total yield should thus be about 500 cu.m. per ha., to which may be added about 50 cu.m. from understorey Spruce. Aspen needs good, moist, mull soils, but seldom occurs as pure stands in such places. Generation after generation of pure Aspen appears undesirable, and Spruce is valuable as a complementary species, since it increases the yield and aids natural pruning, though it must be prevented from crowding the Aspen excessively. It is possible to leave such Spruce to grow on after final fellings of Aspen: after felling the Spruce, Aspen may be restored with seedling or other stock of controlled quality. Seedlings are preferable to root suckers, as the latter appear more liable to rot and show less sustained increment. A rotation of 60 years or thereabouts is best, as losses by rot increase rapidly at greater ages. [Cf. *For. Abstr.* 7 (Nos. 1781, 1854).]

57 : 22.14.1 : 12.25 : 96.1. WOBST, A. Der Plenter-Schutzwald im Riesengebirge. **[The protective selection forest in the Riesengebirge.]** *Abstr.* in *Forstwiss. Cbl. u. Thar. forstl. Jb.* No. 1, 1944 (46–7). [G.] [2109].

A supplement to a previous paper by the same author [*Forstarchiv* 1942 (21/22)]. In the natural Spruce protection forest described, age varied from 25 to 250 years, diameter from 8 to 73 cm., height from 3 to 25 m., the number of stems was low (334 per ha.) and sectional area and timber volume (312 cu.m. per ha.) relatively high. The mean stem had a crown four-fifths of the total height and wide enough to occupy the available space in spite of the numerically low stocking. Open-grown trees were so branchy that the quality as timber was low for the whole area. Little advance growth was present. The growth of the individual stem was very constant, uniform and of long duration, and the greater part of its volume production occurred only after 100 years of age, neither the current nor the mean volume increment having reached a maximum at 140 years. The selection forest represented the best natural protection against the effects of storms and snow, but as regards yield by volume no advantage of this form over high forest arranged by age classes could be established. In spite of the lack of modification by man, yield factors such as mean diameter, height, sectional area and timber volume, varied little compared with the means of 7 even-aged stands of the same elevation and site quality. Detailed analysis of mensurational data showed differences from the ideal selection forest. The forest was not in equilibrium, but overmature and perhaps regressing. It is stressed that conditions in a natural forest need not be stable, and a warning is issued against comparison of selection and other types of high forest except over large areas and long periods of observation. [Cf. *For. Abstr.* 7 (No. 2116).]

57.0 : 65. HERRICK, A. M. **A numerical evaluation of stand structure.** *J. For.* 43, 1945 (891–9). [2110].

When timber stands are cut to various diameter limits, the production costs depend almost wholly upon two features of the structure of the stands, namely, volume per acre and tree size. As diameter cutting limits in any stand are raised through successive d.b.h. classes, the volume to be cut per acre falls consistently, while the diameter of the tree of average volume rises consistently. Volume per acre usually falls relatively more slowly than average diameter rises in the smaller stand d.b.h. classes. When the volume per acre in and above the various diameter classes is multiplied by the d.b.h. of the tree of average volume in and above the respective classes, a series of cross-products is obtained which reaches a maximum when the rate of decrease in volume per acre equals the rate of increase in the diameter of the trees of average volume. The writer calls the d.b.h. of the tree of average volume, at the point where the series of products reaches a maximum, the 'maximum-product-point d.b.h.' and describes a technique of numerically evaluating stand structure through the use of this factor. Tables are given showing the calculation of maximum-product-point d.b.h. for different types of stand of Shortleaf and Loblolly Pine.

Although stand-structure analyses have commonly been used in connexion with the economics of logging, it is suggested that stand-structure factors might be used in other directions. In silviculture, for instance, structure classes might be used in place of the more cumbersome stand-and-stock tables. Since it indicates a measure of physiological maturity, the structure factor should prove useful in forest protection as an index of susceptibility, decadence, or fire hazard.

57.4 (485). ENANDER, M., and HEIJBEL, I. Produktionsundersökningar å skogshögskolans övningsområden å Garpenbergs Kronopark. **[Yield investigations in the demonstration areas of the Swedish Forestry School in the Crown Park of Garpenberg.]** *Svenska SkogsvFören. Tidskr.* 44, 1946 (60–72). [Sw.g.] [2111].

An interim report on the permanent sample plots described in *Skogshögskolans festskrift år 1928*, in which yield investigations were made by the authors, and on intentions for future research. Studies will be made of dimension fellings, two-storeyed forest with an upper storey mainly of high-quality Pine, modified clear felling with seedbearers according to Wahlgren's principles, and regeneration under Pine shelterwood. After the next revision, in 1950, it should be possible to publish the results of mensurational studies.

6. MANAGEMENT. WORKING PLANS. SURVEYS

60. GENERAL LAND MANAGEMENT

60.1. *Management of Non-forest Land*

60.1 (73) : 11.6. BAILEY, R. W. **Determining trend of range-watershed condition essential to success in management.** *J. For.* 43, 1945 (733–7). [Intermountain Forest and Range Exp. Sta., Ogden, Utah.] [2112].

Accurate determination of condition and trend of plant cover and soil mantle, site by site, is considered to be the key to satisfactory range management of catchment areas. Indicators of conditions used in the past have been mainly restricted to plants, and this has often led to wrong conclusions. Proper-use factors and key species are valuable only when they are derived from a sound ecological understanding of the area, and even then must be used in conjunction with other evidence such as is associated with the soil. Successful range management demands the power to estimate by inspection the relative infiltration capacity of the soil, potential productivity of the soil, susceptibility of soil to disturbance by trampling and grazing, changes that have occurred or are occurring in the soil because of use, such as leaching of the plant food, sheet washing, and shoestring gullying, and the meaning of these changes in terms of productivity, infiltration capacity and stability. Much more research is needed on these lines, and higher standards of technical training and experience must be set up as qualifications for the professional range-catchment manager.

60.2. *Management of Tree Plantations under Non-forest Conditions*

60.2 (54.2) : 23.2 : 11.48. JOSHI, K. D. **Unirrigated canal plantations in the United Provinces.** *Indian For.* 71, 1945 (331–5). [Paper presented at the 6th Silvicultural Conference, Dehra Dun, 1945.] [2113].

The Forest Department, U.P., manages on behalf of the Irrigation Department a total area of 24,263 acres of canal-bank plantations, which are maintained to provide timber, fuel, fodder and shade for local needs. Of this total, some 18,400 acres are unirrigated. This article gives an account of the management of these unirrigated plantations. The principal species are Sissoo (*Dalbergia sissoo*) and Babul (*Acacia arabica*) with occasional Teak, Jamun (*Eugenia jambolana*), Nim (*Azadirachta indica*), Mango and other species. The system followed is clear felling (except for the reservation of two shade trees per furlong) and artificial regeneration. In sandy areas stumps and transplants do best, and here Sissoo is generally preferred; Babul sowings also thrive in such soils. In clayey soils Babul or Khair (*Acacia catechu*) sowings, Jamun transplants or sowings, Siris (*Albizzia* spp.) stumps or sowings, Mango transplants and Bamboo rhizomes are found to thrive. In waterlogged areas, Jamun transplants do tolerably well. Kanju (*Holoptelea integrifolia*) sowings also do well. In the poor *usar* (alkaline) areas, except heavy *usar* in which no work is attempted, Nim, Imli (*Tamarindus indica*) or Siris cuttings or transplants do best.

60.2 : 38.63 : 23.2 (54.5). MAHENDRU, I. D. **Irrigated plantations of the Punjab.** *Indian For.* 71, 1945 (370–8). [Paper read at the 6th Silvicultural Conference, Dehra Dun, 1945.] [2114].

The establishment of irrigated plantations in the Punjab was the direct outcome of the policy of the Punjab Government on the reservation of land for raising tree crops to meet the need for fuel. The first irrigated plantation was started in 1866 by the Punjab Forest Department at Changa Manga, and the total acreage now exceeds 47,000. This paper gives a general account of the location, soil, irrigation system, sowing, planting and tending, system of management, growing stock and yield, and financial results of the individual plantations in some detail. Ten thousand acres are considered the ideal unit from the point of view of management. Depth is the most important single soil factor on which success depends. A site for a plantation should be selected as near as possible to the headworks of a canal in order to ensure an adequate supply of water. Various irrigation problems are discussed, e.g. trench irrigation versus floodings, shallow versus deep irrigation, water requirements of plantation crops.

Extensive irrigated plantations under varying conditions have brought to light a number of factors adverse to the development of pure Shisham (*Dalbergia sissoo*) crops. This species does not do well on alkaline or sandy soils, for which *Tamarix*, *Melia* and *Prosopis* species are more suitable. With the limited water supply available for plantations, the introduction of xerophytic species is necessary in the interests of water economy and the best development of Shisham stands. The plantation species in descending order of water requirements are Mulberry, Shisham, Farash (*Tamarix* spp.), Bakain (*Melia azedarach*) and *Prosopis*. Pure crops of Shisham are particularly susceptible to insect and fungus attacks; two serious pests are the defoliator *Plecoptera reflexa* and *Fomes lucidus*. For this reason, the establishment of mixed stands dominated by Shisham, by means of the introduction of suitable species in the lower storey, is considered desirable. Owing to its tolerance of alkali salts, Farash has been extensively planted on *kallar* soils, but though the plants do well for a time, they tend to stagnate in growth 3 or 4 years after their establishment. For underplanting, Bakain has proved almost ideal. Introduced as an understorey, it remains there during the first rotation. During the next rotation it joins the overwood and forms a mixture with Shisham ecologically as well as economically.

60.2 : 23.2 : 24 : 38.63 (54.5). Chopra, R. S. **The technique and problems of irrigated plantations of the Punjab.** *Indian For.* 71, 1945 (378–87). [Paper read at the 6th Silvicultural Conference, Dehra Dun, 1945.] [2115].

The paper reviews the technique of irrigated plantations in the Punjab, discussing in detail the lay-out of the area, the choice of species, method of stocking, thinnings, irrigation. It may be said that a technique has now been evolved under which plantations can successfully be raised in the province given an adequate water supply and a reasonably fertile soil. Questions relating to the later phases of plantation management which still await solution, particularly the improvement and maintenance of sustained yield, and methods of regenerating and tending the crops, are briefly discussed.

60.3. *Management of Different Classes of Forest*

60.3 : 22.88 : 57 (43.7 : 43.8). Heger, A. Aufbau und Leistung von naturnahen Wäldern im Osten und ihre forstwirtschaftliche Behandlung. **[Structure and yield of quasi-virgin forests in eastern Europe, and their management.]** *Abstr.* in *Forstwiss. Cbl. u. Thar. forstl. Jb.* No. 1, 1944 (34-5). [G.] [2116].

The expected continuation of German occupation in eastern Europe would have presented the occupiers with some residual virgin and quasi-virgin forest, for the management of which there would have been no satisfactory precedent in Germany. It is pointed out that at 1,300 m. altitude in the western Beskid Mts. (borders of Poland and Czechslovakia), a virgin stand had a stocking of 500 cu.m. and a current increment of 6 cu.m. of stemwood per ha. There are indications that original stands at rather lower altitudes carried over 700 cu.m. per ha. Conversion of such forests, after clear felling, to pure Spruce, lowered the growing stock to 200 cu.m. per ha., owing largely to the susceptibility of pure Spruce to damage and to deterioration of locality factors consequent upon clear felling. It is therefore urged that virgin and natural forests in eastern Europe should be so managed that their natural structure and increment capacity may be fully preserved. Such areas would also be of great value for scientific study. [Cf. *For. Abstr.* 7 (Nos. 1714, 2018, 2109).]

60.31 (71) : 32.3 : 33.02. **Silvicultural meeting at Petawawa.** *For. Chron.* 21, 1945 (205–18). [2117].

At the suggestion of the Executive Council of the Woodlands Section, Canadian Pulp and Paper Association, a meeting was held at Petawawa Forest Experiment Station in May, 1945, to define the main needs of silvicultural research on behalf of pulpwood forests, to consider the facilities, and to outline a plan of action. Discussion was more or less confined to the following items:—(*a*) choice of desirable species for industrial use; (*b*) silvicultural characteristics of the chief species from germination to maturity; (*c*) control of regeneration through choice of harvest cutting (what is silviculturally desirable cutting in typical cases; and how to reconcile this, when required, with the maximum economy in logging); (*d*) commercial possibilities of artificial regeneration; (*e*) practical means for increasing growth rate of desirable species; (*f*) treatment of slash; (*g*) silvicultural methods of diminishing forest vulnerability. A fairly full account is given of the discussions at the conclusion of which the following resolutions were unanimously adopted.

I. Whereas it is recognized by the forest industry and governments that there is an urgent and definite need for fundamental and factual data on regeneration on cut-over areas and rate-of-growth surveys, and whereas such information is essential to the perpetuation of Canada's forest resources, a Joint Committee should be set up, consisting of representatives from the forest industry, Provincial and Dominion Government Forest Services, with a view to finding ways and means of implementing the proposals with respect to surveys as outlined in the papers presented by the Dominion Forest Service at this meeting.

II. Whereas experimental work is necessary in our pulpwood forests to study methods for increasing the growth rate of desirable species, experimental areas should be established for such purposes.

III. Whereas it is essential to collect and review all available data pertaining to Canada's forests and tree species, preparatory to conduct of further research and to the application of forest management practices, the Woodlands Section should consider recommending to the Dominion Forest Service that the Dominion Forest Service undertake the collection and review of such data, its publication and dissemination.

Among the projects inspected by the conference were experimental cutting of Black Spruce cover type, debudding experiments, succession cutting in Pine, selection cutting in Pine, strip cutting, splintwood and pulpwood cutting in Jack Pine, tree breeding, and woodlot management.

60.31 (77.4) : 12.19.2. DAY, M. W. **Forest management for the eastern part of the Upper Peninsula of Michigan.** *Circ. Bull. Mich. agric. Exp. Sta.* No. 190, 1944. pp. 22. [2118].

The methods of managing farm woodlands and other forest areas in north-eastern Michigan, described in this bulletin, are based on data accumulated at the Dunbar Forest Experiment Station at Sault Ste. Marie. The main types dealt with are Northern hardwood, Spruce/Fir, Pine, Aspen, Cedar and Spruce swamp type.

60.31.2 : 67. WRIGHT, H. L. **Working plans for estate woodlands.** *Quart. J. For.* 40, 1946 (23–7). [2119].

The writer of this article, having acted as an Acquisition Officer in England during the war, after 30 years in the Indian Forest Service, is struck by the lack of planning in English estate forestry. The fact that so many estates have been depleted makes it the more imperative that those that remain should be brought under a sound system of management. This involves a complete stocktaking, the definition of the objects of management and the preparation of a working plan, to be revised in, say, 10 years' time. For most estates the working plan need be little more than a simple plan of operations to cover ten years, but the prescriptions must be definite, with definite areas prescribed for felling, for tending and for replanting each year, and with details of any other operations, such as the repairs and maintenance of fencing, which have to be carried out.

60.31.2 (41.1–4) : 09.1. PETRIE, S. M. **Wight's observations on estate forestry in 18th century Scotland.** *Scot. For. J.* 59, 1945 (87–98). [2120].

Notes on 'The Present State of Husbandry in Scotland' 1778–84 by Andrew Wight, a farmer in Midlothian, which contains many observations on the subject of trees and their management, though it deals primarily with agriculture.

60.31.2 (73) : 91.8. REYNOLDS, H. A. **More about the small holding.** *J. For.* 43, 1945 (713–4). [Massachusetts Forest and Park Association, Boston, Mass.] [2121].

The writer comments on a previous article [see *For. Abstr.* 7 (No. 460)] which favoured the private 'farm forester' rather than the public forest services as adviser to the farmer in the management of his woodland. He believes that a better solution lies in a complete forestry service, rendered by adequately trained public or private foresters and paid for by the owner.

60.31.2 (76.8) : 06.6. SEIGWORTH, K. J. **Forest management on private lands in the Tennessee Valley.** *J. For.* 43, 1945 (705–9). [Department of Forestry Relations, Tennessee Valley Authority, Norris, Tenn.] [2122].

Public forestry agencies, landowners and forest industries in the Tennessee Valley are developing an effective method for getting desirable cutting practices applied on privately owned lands by voluntary participation in management demonstrations. This article presents a short summary and estimate of progress in demonstrations in which the T.V.A. has participated.

61. SURVEYING. MAPPING

61 (494). RIEBEN, E. Le plan d'ensemble de la mensuration cadastrale et son utilisation dans l'économie forestière. [**The general map of the land-registration survey, and its use in forestry economy.**] *J. for. suisse* 96, 1945 (163–71). [F.] [2123].

The writer urges the use of the general map (*plan d'ensemble*), produced by the Swiss Federal topographical service as a basis for the cadastral map, in the revision of forest maps and working plans. It is a topographical map, showing boundaries between communes, the exact position of buildings, reservoirs, springs, barrages, the walls of pastures, roads, and footpaths, the boundary between forest and arable, high tension lines, and many topographical details. It is on a scale of 1 : 2,500 for built-up areas, 1 : 5,000 for valuable land and 1 : 10,000 for other areas. Contour lines are given at 10-m. intervals for slopes of more than 5 per cent. and at 5-m. intervals for more gradual slopes.

61.32. Crow, A. B. **A method of determining forest areas from aerial photograph index sheets.** *J. For.* 43, 1945 (812–3). [2124].

A method is described for easily and quickly determining forest areas for a county or state where aerial photograph index sheets are available. The index sheets used in the study described were mosaics made from contact prints on a scale of about 1/20,000, assembled and re-photographed to a scale of about 1 in. to the mile. Summer photographs are best, since the distinction between woodland and other classes of land is then most clear. When all sheets for the area to be dealt with are assembled, the first step is to mark off the overlap so that no area is duplicated. Cruise lines are then drawn in pencil about 1 in. apart and an ordinary pair of bow dividers set to establish successive points along the cruise lines as forest or non-forest. When the entire area has been covered the number of points of each kind are added up and the percentage of forest determined. In the present study it was found that with cruise lines 1 in. apart (about 1 mile on the ground) and the dividers set at ¼ in. (¼ mile on the ground) enough points were obtained to strike well below the predetermined sampling accuracy of ± 10 per cent., where forest area for the county exceeded 25 per cent. The cruise lines need only be 2 in. apart where forest area approaches 50 per cent.

Light rather than dark printing of the photographs is desirable. It was found that photographs on a scale of ¾ in. to the mile were much more difficult to read and those of ½ in. to the mile could not be used at all unless very clearly printed.

An entire county of 400,000 acres can be worked in about 2 hours. Though one man can do the work alone, a team of 3 is best when the area to be surveyed is large. One man matches the sheets, decides on spacing and rules the cruise lines; another operates the dividers and identifies the points, calling them out to a tally man who records the results.

61.32 : 12.19. Jenkins, D. W. **Use of the airplane in vegetation surveys.** *Ecology* 26, 1945 (413–4). [Department of Botany, Univ. of Minnesota.] [2125].

Certain species of trees can be identified from altitudes up to 1,000 ft. if the trees have some distinguishing characteristics and if the species are thoroughly studied from the ground before flying. The main characters used in identification are colour, shape and size of the whole tree and of the leaves; colour of young or old leaves which are turning colour; distinctive coloured flowers or fruits; type of habitat and relation to physiography; and plant associates and easily recognized indicator plants. While surveying the forests and jungles of Central America for rubber trees (*Castilloa*) it was found that the large elongate leaves arranged in pinnate rows on the branches and the characteristic shape of the trees made positive identification possible. Both these and *Hevea* trees were more easily identified at the beginning of the dry season when the leaves changed colour. Several species of trees which were very obvious from the air sometimes served as indicator plants. The readily identified *Cecropia* trees, whose large palmate leaves have a white undersurface, were often associated with *Castilloa* and provided an easy means of locating stands. The dark-green glossy leaves and whitish-purple, bell-shaped flowers of *Cryptostegia* were easily recognizable.

Palms were perhaps the plant most readily identified from the air, and with practice some of the species could be separated. A survey of palm-kernel- and palm-oil-producing species was made in Central America, and it was found possible to distinguish the Cohune (*Orbignya cohune*), Corozo (*Scheelea* spp.) and Coyol (*Acrocomia* spp.) and other types of Palm.

While flying, the general distribution of the species being surveyed was plotted on maps, and the approximate density was indicated by a system of crosshatching or by numerical estimates of the number of plants per unit area. In order to check these estimates, specific points such as road and river junctions were marked at intervals on the map. The points accessible from land were then surveyed for exact density by the quadrat method. Resurveying from the air where a second flight could be made and correcting original estimates on the basis of the known densities gave much more accurate results.

The machines used in the surveys were the Navy 052U Observation Scout Plane, the Navy Patrol Bomber PBY4, Piper Cubs, and others. Speed varied from 55 to 120 miles per hour. Binoculars were found to be of no use, owing to the speed of the planes. It was found that persons having long-sighted vision were better able to make out difficult identification characteristics.

Air photographs and mosaics have been used with success in ecological surveys, but it is almost impossible to identify tropical species from the photographs. Air surveying will probably prove most valuable in surveying tropical forests and swamp and marsh land where travel on the ground is very difficult.

63. ROTATION

63 : 76 : 95.1. Mattson Mårn, L. Några praktiskt utförda omloppstidskalkyler. **[Some calculations of rotation period carried out in practice.]** *Svenska SkogsvFören. Tidskr.* 43, 1945 (445–52). [Sw.] [2126].

Calculations based on data for 3 fairly large forest enterprises, with variation of factors such as rate of interest, future prices for produce, floating costs, thinning practice and increment, strongly suggest that the rotation period is relatively constant for a given tract (of average site quality and rate of interest, though the latter has not such a great influence as is generally supposed), and that it is not easily modified by timber prices or wage levels. It is also comparatively independent of variations in normal thinning practice, except that late incidence of the first thinning may significantly prolong the period. Details of the method of calculation are not given, but stress is laid on the rigid differentiation between short-term (e.g. felling and extraction) and long-term (e.g. ordinary silvicultural) costs and on the reckoning of costs strictly for the time during which they encumber the business and are themselves subject to interest, on the use only of net stumpage values, and on the necessity of discriminating between assortments of produce. Taxes were disregarded on the assumption that if they materially affect an otherwise correct calculation regarding proper management, they should be adjusted, and, as this is probably the case, the need is urged for further fundamental study of the considerations raised.

65. DESCRIPTION OF GROWING STOCK

65 : 01.7. Goodspeed, A. W. **Determination of the regulated empirical growing stock from field data.** *J. For.* 43, 1945 (908–14). [2127].

In managing a working circle the forester seeks an estimate of the growing stock required to support a yield based on the actually expected, rather than the normal, increment for the working circle. This growing stock, which has been named the regulated empirical growing stock, may be designated by the symbol G_ϵ. This estimate, when compared with the actual growing stock (G_a), tells the forester whether he has a surplus to be reduced or a deficit to be made up. The author points out that the usual formulas used for determining the regulated empirical growing stock are unsound because of the assumption that increment in even-aged forest stands is laid on in equal instalments, and he develops and illustrates a more accurate method for determining growing stock by the use of a fourth-degree equation of the form

$$G_\epsilon = \epsilon r^4 + fr^3 + gr^2 + hr + C.$$

The field data on which the formula is based are the age (in years) and volume in bd. ft. per acre in 4 stands such as would be used for constructing an empirical yield table.

65 (494) : 56.3. Bauer, S. Matériel sur pied et accroissement. **[Growing stock and increment.]** *J. for. suisse* 96, 1945 (180–5). [F.] [2128].

Swiss Federal forest statistics, though perhaps the best in the world, lack one important class of data, namely the amount of growing stock and its annual increment. The writer proposes to remedy this deficiency by the use of a revised form to be filled in simultaneously with the revision or elaboration of working plans, and forwarded to the statistical section of the Federal Inspectorate of Forests. The proposed form is reproduced and discussed.

66. POSSIBILITY. SUSTAINED YIELD. YIELD REGULATION

66 (494) : 96. Péter, J. Le problème des surexploitations. **[The problem of over-exploitation.]** *J. for. suisse* 96, 1945 (131–4). [F.] [2129].

It will take several decades of rigid economy to make good the heavy over-exploitation of Swiss forests during the war. The writer points out that the indirect loss through deterioration of soil and climate, and consequent reduction in rate of increment of the remaining stands, is no less important than the direct loss. The liquidation of these losses is indispensable and can only be effected by economizing on future increment and leaving in the forest a volume corresponding to that removed by over-exploitation during the war.

66 (494) : 96.3. Grivaz, F. La forêt vaudoise au service du pays pendant la guerre. [**The forests of the Canton of Vaud in the service of the country during the war.**] *Schweiz. Z. Forstw.* 97, 1946 (65–76). [F.g.] [2130].

A general review and comparison of war-time and previous fellings. In 1939 the growing stock in the forests of Vaud showed a deficit of 6–8 million cu.m. and this has been increased by 1·3–1·5 million cu.m. through the excess war-time fellings. Fellings for 1940–45 were about 150 per cent. of those for 1914–19, which were not greatly in excess of those of the two periods 1925–29 and 1935–39. The Canton produced during the second world war 1½ million cu.m. of timber and 3½ million stacked cu.m. of fuelwood. More than 1,400 ha. was deforested.

66 (54.7). Sind. **Annual administration report of the Sind Forest Department for the year 1943–44.** Govt. Press, Karachi. 1945. pp. viii + 21. [2131].

The average annual pre-war cut was 18–19 million cu. ft. (stacked); in 1943–44 32 million cu. ft. (stacked) were felled. The 1942 and 1943 abkalanis have greatly benefited the forest estate but not sufficiently to permit an increase in the cut from 15 to 32 million cu. ft. and serious overfelling of mature areas has resulted. Outturn from privately owned woods, jagirs, huris and waste lands is decreasing, owing to clearance, and further strain on the forest estate is thereby expected; the fuel situation within the next 2–3 years may be serious unless industries can use larger quantities of coal, charcoal briquettes, sawdust, etc. (pp. 1–2).

66 : 12.25. Pearson, G. A. **More about Ponderosa Pine cutting cycles.** *J. For.* 43, 1945 (840–2). [2132].

The writer comments on a previous article which in turn arose out of one written by himself [see *For. Abstr.* 6 (201)]. He stresses the fact that separate records of growth, mortality, and ingrowth are necessary in order to assess the various components of increment and determine what measures should be taken to improve yield; and deplores the recent tendency to neglect keeping such records for sample plots established 20 to 30 years ago.

66 : 22.14.1 : 12.25. François, T. Une belle sapinière du Forez: la forêt syndicale d'Aubusson. [**A fine Fir wood of Forez: the forest of Aubusson.**] *Rev. Eaux For.* 83, 1946 (397–412). [F.] [2133].

The forest here described has always been managed as selection forest. The writer analyses the available data from successive inventories, in order to determine the optimum rate of exploitation, and deduces that the mean volume of the merchantable tree for the next rotation should be in the neighbourhood of 1·6 or 1·7 cu.m. He stresses the value of this conception of the mean volume of the merchantable tree, in marking such a forest for felling.

66 : 22.82 : 76. Roth, C. Anpassung der Hiebsätze an waldbauliche Notwendigkeiten. [**Adaptation of the annual yield to silvicultural requirements.**] *Schweiz. Z. Forstw.* 96, 1945 (58–62). [G.] [2134].

Two examples are quoted to show that in maturing even-aged Spruce stands it is impossible for silvicultural reasons (e.g. in the one case the necessity of rapidly clearing defective stands, and in the other the poor prospects of any worth-while return from thinnings as against valuable volume and quality increment) to apply fellings according to the annual yield as determined by formula. The difficulty arises chiefly with such even-aged stands, and the solution offered is to determine the actual growing stock that will become available, in the next working period, for felling without detriment to silvicultural requirements. Only an approximate determination of this quantity will be possible, and probably the forest officer in charge will be best able to make the assessment in the light of his experience and intentions. A hypothetical case is presented from which it is argued that the loss of interest as a result of reduced fellings would be greatly exceeded by the cost of artificial regeneration after clear felling, which might in some cases be the only alternative. It is suggested that a return should be made to the use of felling plans specifying annual yield for individual compartments, but that the yields so specified should be estimated by the forester in charge with due consideration of silvicultural needs. Such methods, however, would appear too time-consuming for use in large forests.

66 : 22.8. KNUCHEL, H. Zur Hiebsatzbestimmung in nicht normalen Revieren. **[On the determination of the annual yield in abnormally stocked forest districts.]** *Schweiz. Z. Forstw.* 96, 1945 (62–7). [G.] [2135].

A brief review is made, in connexion with a paper by Roth [cf. preceding abstract], of annual yield formulae, including Mantel's (Masson's), the utilization per cent., and Heyer's formula with the modified values as used in the méthode du contrôle. None of these, however, can allow for the types of abnormal stocking quoted by Roth, and Roth's suggestion of a return to felling plans with allowance for silvicultural requirements is approved. It is pointed out that felling plans based on an estimated utilization per cent. have been used in Vaud and Neuchâtel with satisfactory results.

7. FOREST ECONOMICS, VALUATION, AND FINANCE

74. VALUE OF THE STAND. VALUE OF THE FOREST

74 : 22.14.1. PETRINI, S. Normalskogsberäkningar i blädningsskog. **[Normal-forest calculations in selection forest.]** *Svenska SkogsvFören. Tidskr.* 43, 1945 (354–61). [Sw.g.] [2136].

In extension of a previous paper [cf. *For. Abstr.* 5 (209)] the appropriate formulae are developed, for the first time, for selection forest. Despite the lack of the concept of a rotation period, the time factor and also special methods for determining the value of the land and the net expectation value of the growing stock, must be introduced. (i) *The total value of a selection forest*: Assuming uniform site quality, homogeneous structure of the growing stock, natural regeneration obtained gratis, growing stock reckoned down to a specified diameter limit, fellings annually equalling increment, and for simplicity only 3 diameter classes, a method is described of determining the stumpage value of fellings, allowing for recruitment, of young growth and from class to class, as the difference of the values of autumn and spring growing stock. The total value of the forest enterprise is then obtained by deducting general costs from stumpage value of fellings and dividing by 0·0*p*, where *p* is the rate of interest. It is noted that the spring value of the enterprise is regarded as the productive capital. The total value of the enterprise equals value of the land plus net expectation value of growing stock. (ii) *A 'crude' net expectation value of growing stock* can be obtained as the present value of the stumpage values of consecutive annual fellings for the period of realization of the diameter classes involved; this requires knowledge of the proportion of annual fellings per diameter class and the period of realization for each class. (iii) *Net expectation value of growing stock and value of land*: The former value can be obtained if from the crude net expectation value are deducted (*a*) present value of all general costs for period of realization, and (*b*) present value of interest on the value of the land used, with allowance for the fact that not the whole area is in use all the time. Subtracting (*a*) from the crude net expectation value, a 'preliminary' net expectation value is obtained, which is too high since the unknown value of the land is still represented. A 'preliminary' land value is now calculated by deducting the preliminary net expectation value of the growing stock: this is too low because the preliminary net expectation value is too high. Now by inserting the preliminary land value in the formula for preliminary net expectation value, a better approximation can be obtained, and by repetition of the process any desired degree of accuracy may be achieved, thus solving the general problem set. (iv) *The reserve for development*: By this is understood the trees below the diameter limit set for growing stock. These are an economic asset provided by natural regeneration, and it is convenient to regard the value of this natural regeneration as equalling the capitalized costs of artificial regeneration under the same conditions, and on this view natural regeneration will give the forest a higher value than would artificial regeneration. This added value is already accounted for in the total value of the enterprise, as calculated above. For reasons detailed, it is considered best to regard the value of the young growth as included in the value of the land. Where, as will usually be the case, costs are incurred in connexion with the natural regeneration before it passes into the main growing stock, they must naturally be properly charged, e.g. if cleanings do not pay their own way a true cultivation cost arises and this must be deducted from the net yield before the latter is capitalized. It is stressed that such considerations only affect the total value of the enterprise and that of the land: they in no way influence the crude net expectation value of the growing stock and have only an indirect effect (through changed land value and interest thereon) on its net expectation value.

74 : 78. Leddet, F. Le revenu réel et la valeur d'avenir des peuplements artificiels. **[The true financial return and future value of artificial stands.]** *Rev. Eaux For.* 83, 1945 (95–8). [F.] [2137].

Most writers take the financial return of an area of forest to be the sum produced by its sale at the normal age of exploitation, and use this value as a basis for calculating forest interest, taxable value, compensation to the owner for exploitation, etc. The writer argues that, though this may be valid for a stand which regenerates naturally, it is not so for artificial stands such as certain Pine and Poplar plantations, the exploitation of which leaves the soil bare and incapable of producing more wood without human intervention. In such cases, the real financial return is the difference between the value of the area at the age of normal exploitation and the cost of reforestation, that is to say, the sum which remains when the soil has once more been put into a condition to produce wood as before.

In order to calculate the future value of an area of forest at age m the following formula may be used

$$x = r\,\frac{(1+t)^m - 1}{(1+t)^n - 1} + P$$

where r = real financial return, n = normal age of exploitation, t = current rate of interest, and P = cost of reforestation.

76. MANAGEMENT STATISTICS

76 (44) : 23.24 : 22.83. Berger, L. Que rapporte au propriétaire le reboisement? **[What is the return to the owner from reforestation?]** *Bull. Soc. for. Franche-Comté* 25, 1945 (332–9). [F.] [2138].

The writer urges that reforestation is a profitable form of investment and has peculiar advantages, being relatively unaffected by the fluctuations of money value, whilst the continued or increased utilization of wood in the future is certain. He gives calculations based on estimated costs of planting and of land at the present time and prices at present obtaining for timber, to show that planting is financially remunerative, on three conditions: (1) it is necessary to plant high-yielding species, (2) it is necessary, in order to minimize losses from windthrow, frost, insects, etc., to plant mixtures (e.g. Douglas Fir, Sitka Spruce, Scots Pine and Larch), and (3) it is necessary to tend the plantations. He advocates the transformation of much of the existing, unremunerative French coppice or coppice with standards, into such mixed coniferous plantations by planting 300 plants to the hectare of Douglas Fir, Japanese Larch, Sitka Spruce and *Abies grandis*, 2 to 4 years before felling, and completing the plantation by doubling the numbers after the felling of the original stand.

76 (481) : 94.3 : 60.31.2. Langsæter, A. Regnskapssammendrag for en del privatskoger, 1933–38. **[Summary of accounts for a number of private forests, 1933–38.]** *Medd. norske Skogforsøksv.* 8 (No. 28), 1942 (217–55). [Nor.] [2139].

Statistics of income and expenditure for 29 private forests in Trøndelag, Østfold, Akershus and Hedmark, obtained from replies to a questionnaire, are presented and discussed.

76.1. **Good forestry in the South: the cost of growing trees.** *Pulp Paper Ind.* 19 (10), 1945 (28–30). P.O. [2140].

A brief review of forest management in the Southern United States. It is estimated that the cost of growing Longleaf Pine per acre is:—

Cost of bare land suitable for planting	$2·00
Planting (seedlings and labour) . .	5·00
Replanting	1·00
Taxes (annual)	·08–·12
Fire protection (annual). (Farmers might not have this expense) . .	·05–·06

At the end of 25 years the land should have a stand of 50 cords per acre, producing $80. Logging methods are also briefly reviewed.

76.2 : 60 : 31.2. Locke, S. S. **Income from farm woodlands.** With comment by J. F. Preston. *J. For.* 43, 1945 (723–8). [Soil Conservation Service, Milwaukee, Wis.] [2141].

Records of managed woodlands on 89 farms for 6 years are summarized and analysed. The records were compiled to show the actual financial return from the management of a representative number of farm woodlands. There has been little hitherto in forestry literature on the setting up of an accounting system for the income and expense of the farm woodland enterprise. The methods used in obtaining these records are described and the results interpreted. The writer considers that for the purpose of impressing the farmer, return on labour is a more significant factor than annual net profit per acre or rate of interest on investment. The only disadvantage of the labour-return method is that its principal factor, the actual time spent on wood operations, is the one subject to the greatest error. An examination of the records shows that the average farmer in the high-income group of woodlands worked at the rate of 6·8 hours per acre annually, while those in the medium and low groups spent 4·1 and 2·6 hours respectively per acre per year.

The comment on the article suggests other significant arrangements of the author's figures, e.g. to give rent and profit per acre.

78. CALCULATION OF PRESENT AND FUTURE VALUES

78 : 57 : 12.25. Langsæter, A. Hjelpetabeller ved økonomiske kalkyler i skogbruket. I. Balansemassetall for gran, omkostninger ved skogkultur, m.v. [**Auxiliary tables for economic calculations in forestry. I. Discount factors for Spruce, artificial regeneration costs, etc.**] *Medd. norske Skogforsøksv.* 9 (No. 32), 1945 (129–79). [Nor.] [2142].

Provisional tables are given of (i) volume and increment under bark, per ha., for normal even-aged woods of standard site qualities according to the Norwegian Forest Survey method; (ii) discount factors for calculating the present value of all future crops (Spruce) with various thinning grades, rates of interest and rotations, by diameter classes; (iii) the amount that can be invested in cultivation costs without making the enterprise less profitable than natural regeneration giving the same money yield or one 10 per cent. lower; and (iv) values of main yield plus thinnings with interest to the end of a rotation.

The use of the tables for economic calculations is discussed.

8. FOREST ADMINISTRATION

81. ORGANIZATION. REGULATION OF SERVICE

81 (494). Rüedi, K. Zur Frage der Organisation des untern Forstdienstes. [**The question of the organization of the lower grades of the forest service.**] *Schweiz. Z. Forstw.* 96, 1945 (12–6). [G.] [2143].

The prevailing custom of employing a resident forester for every unit, however small, of Swiss communal and corporation forests, and the lack of uniformity in the technical training of such persons, are deprecated. On the other hand, an organization like that of the State forest divisions would be unsuitable, at least in Zurich and the thickly populated midland regions, where the supervision of work and prevention of forest offences are best done on an essentially local basis. In spite of opposition, some progress has been made locally in bringing separate units under the charge of a single forester, but legislation may still be necessary to achieve sufficient in this direction. Control would have to be elastic to meet varying local conditions. Efforts must also be made to secure a more uniform standard of education; in this connexion it is recommended that the cost of courses should fall on the forest estate and not on the candidate.

81 : 11.62.11 (54.7) : 97.1. Sausman, V. A. N. **Organization and legal position of the land improvement section, Province of Bombay.** *Indian For.* 71, 1945 (410–6). [2144].

An account of the organization set up in Bombay as part of the post-war reconstruction scheme for alleviating economic conditions in the Deccan. The organization and administrative units are divided on the basis of functions rather than programmes. For example, since the technique of tree planting is the same whether the tree be planted for erosion control, flood control, sub-marginal land development or any other purpose, the same man will administer tree planting for all purposes. The functional type of organization is carried down through the various levels of authority.

Preliminary work carried out by the writer as Land Development Officer, Scarcity Area, made it clear that problems of soil erosion did not begin or end at village boundaries, and that the unit for treatment is the catchment area. Further, the rainfall is so scanty, and precipitation so irregular and uncertain in the Deccan that, while any given precipitation may be surplus at the time, there is never any assurance that it is in excess. The key to the problem was to treat any heavy precipitation as surplus but not as an excess, and to impound all rainfall as and when it falls. This led to the abolition of waste-weirs and the spacing of bunds at somewhat closer intervals over the whole catchment.

81 (73) : 91.8. **Postwar requirements for foresters: preliminary report, Committee on Manpower, Society of American Foresters.** *J. For.* 43, 1945 (783–97). [2145].

This report presents the first results of an attempt to estimate post-war requirements for foresters in the United States by regions, agencies, and lines of work. The figures are based on replies to questionnaries and, though they lay no claim to completeness or accuracy, they are the best indication available of the probable demand during the next 5 to 10 years.

82. LABOUR QUESTIONS

82 (44). BERTHON, R. Le problème de la main-d'oeuvre forestière. **[The problem of forest labour.]** *Rev. Eaux For.* 83, 1945 (218–22). [F.] [2146].

The writer urges the establishment of a number of forestry units under State control, to go to any part of France where labour shortage is severe, and carry out the necessary tasks of thinning and pruning, which in many parts of the country are being neglected for lack of man power.

82 (47.1) : 32.25 : 33.06 : 33.7. HEIKEL, A. M. Brännvedsavverkning i form av folkhyggen. Något om finska åtgärder för att häva bränslebristen. **[Fuelwood operations in the form of a national cutting: note on Finnish measures to meet the shortage of fuel.]** *Skogen* 32, 1945 (341–2). [Sw.] [2147].

To help to remedy the war-time shortage of fuelwood caused by scarcity of labour and transport, a nation-wide drive was instituted in autumn 1942 for every able-bodied person to cut at least 1 stacked cu.m. of wood. The drive lasted two months and included competitions; the winning commune cut 6·5 cu.m. per man in 6 hours. In 1942 a total of 1,300,000 stacked cu.m. was cut under this scheme, known as a 'Vedtalko'. Similar schemes were continued in 1943 and 1944, until labour was again available when the military were granted home leave. In autumn 1944 the city of Helsinki ran a scheme of its own on similar lines.

Competitions have aroused much interest and have proved a good means of propaganda for efficient methods of work and proper care of tools. The champion in the last competition set up a new Finnish record by converting 55·75 stacked cu.m. in 4 days.

82 (47.1) : 32.2. KARLIN, R. Finska mästerskapen i vedhuggning. **[Finnish cordwood cutting championships.]** *Skogen* 32, 1945 (384–7). [2148].

82 (485). NENZELL, G. Skogsförvaltningspersonal studerar rationalisering. Kurs i Bräcke—den första i sitt slag i Norrland. **[Forest administration personnel study rationalization: course at Bräcke—the first of its kind in Norrland.]** *Skogen* 32, 1945 (359–62). [Sw.] [2149].

82 (485) : 92. 1945 års lag om semester. **[The 1945 law on holidays with pay.]** *Svenska SkogsvFören. Tidskr.* 43, 1945 (498–507). [Sw.] [2150].

A discussion of the new law, which came into force on 1 January 1946, and the circumstances leading up to it. A radical difference from the previous law of 1938 is that the requirement of at least 180 days' employment under the same employer has been dropped; thus seasonal workers in the forests are now entitled to holidays with pay. Workers are entitled to 1 day for every calendar month in which they have worked for the employer for at least 16 days. The employer can determine when the holiday is to be, but must give at least 14 days' notice of the date. Workers paid by the week or a longer period receive normal pay; others receive daily the equivalent of their average daily earnings. 'Unchecked' workers, i.e. those whom the employer can supervise little or not at all, have a right to holiday pay equal to 4 per cent. of wages earned in a quarter, provided that the earned quarterly income is at least the equivalent of 16 days' earnings for the district and job in question, assuming an 8-hour day. Compensation is payable if a man leaves or is dismissed or pensioned off before receiving his holiday and pay. The provisions are considered at some length.

82 : 32.3 : 32.9. Unfälle bei den Holzerei und beim Holztransport. [**Accidents in logging and in timber transport.**] *Schweiz. Z. Forstw.* 96, 1945 (67–9). [G.] [2151].

Accidents in felling and transport were unusually high in the winter 1944–45. An extract is given from rules published for the Canton of Aargau:—(i) *Tools*: bad tools lead to increased fatigue and consequently higher liability to accidents; all tools should be sheathed when being carried. (ii) *Two-man* gangs have shown the lowest accident rate. Gangs must be well spaced on the felling site, and on slopes one gang must not work above another. (iii) *Methods of Work*: No partially cut or lodged trees must be left standing. Saw-cuts must be horizontal, even on a slope. Root snags should be cut away. Vertical splinters on stumps should be removed immediately after felling, when lopping and piling of branchwood should also be done. No felling should be done in strong wind or heavy frost. No persons other than the fellers should be allowed on the site. (iv) Grip soles for boots, knee-pads and gloves are advised. Each gang should carry an emergency dressing.

9. FOREST POLICY

90. GENERAL PRINCIPLES OF FOREST POLICY

90 : 91. Vahid, S. A. **Forestry: its aims, scope and methods.** Osmania University Extension Lecture. 1944. pp. 1 + plate. [Inspector-General of Forests, Hyderabad-Deccan.] [2152].

90 (410) : 98.1. Knuchel, [H.] Holzversorgung und Forstpolitik in Grossbritannien. [**Timber production and forest policy in Great Britain.**] *Schweiz. Z. Forstw.* 96, 1945 (258–65 + plate). [G.] [2153].

A summary based on R. Jefferies' 'The wood from the trees' [see *For. Abstr.* 7 (No. 1256)]. Comment is made on the apparent neglect in British forest policy of the indirect benefits of forests, such as protection against wind and soil erosion, influence on the water régime, protection of the native flora and fauna, improvement of the landscape. It is also noted that communities are not mentioned as possible owners of forest, whereas in Switzerland these have been at least as good as the State.

90 (410). Ackers, C. P. **Our woodlands: their sacrifice and renovation.** Torchstream Books, 50 Alexandra Road, London, S.W.19. 1945. pp. 30. [2154].

After a general survey of the forestry position in Great Britain and the reconstituted Forestry Commission, the author suggests further necessary measures. These include legislation to ensure full development of potential forest land on a sustained-yield basis, the prevention of over-cutting, granting of adequate subsidies, the remission of taxation on woodlands certified as being adequately managed, and a reasonably heavy tax on all woodlands that fail to satisfy the forest authority on their management. Legislation is badly needed to exterminate the rabbit and grey squirrel and to keep the red squirrel within reasonable limits in coniferous areas. Adequate supplies of planting stock and control of tree seed are further necessities.

Access by the general public to private woodlands is desirable, but must be preceded by education; at present much damage is done out of simple ignorance.

The surroundings of the Forestry Commission's school in the Forest of Dean are unsuitable for training men in estate work and new schools should be established on at least 11 selected estates where good forestry has been practised, where estate mill and carpenter's shop can be developed and used for training purposes.

Other points dealt with are possible lines of research; the importance of maintaining an efficient home timber trade and recognizing the sacrifices it has made; marketing and the formation of woodland co-operatives.

90 (41.1–4). GLENTANAR, LORD. **Considerations upon the functions of the forest.** *Scot. For. J.* 59, 1945 (21–8). [2155].

The writer holds that the primary function of forests is biological and ecological, and that the provision of raw material for industry is only secondary from a national point of view. Consequently, he favours mixed and uneven-aged woods rather than pure blocks of even age, especially of conifers. He points out that the Forestry Commissioners' Report on *Post-War Forest Policy* shows no appreciation of this, but recommends a short-term policy of quick timber production, and he hopes that the long-term view will be given full consideration by the Forestry Commissioners in advising the Government on the new forestry policy. *Author's summary.*

90 (44). LELOUP, M. Exposé d'ensemble sur les problèmes forestiers français. **[General account of French forest problems.]** *For. québec.* 10, 1945 (389–405). [F.] [2156].

The report on the French forest situation, presented to the F.A.O. conference at Quebec in October 1945 by the Directeur générale des Eaux et Forêts. The forested area amounts to about one-fifth of the total land area of the country and it is generally agreed that this proportion ought to be increased. There are 5,700,000 ha. classed as wasteland, heath and marsh, much of which could and should be afforested. The measures necessary for remedying the present state of things are threefold:—

(1) The reconstitution of the forest capital wherever the law of 6th August, 1940, prescribing annual exploitation of one and half times the possibility, has led to over-exploitation;

(2) Reconstitution of the forest, where it has been destroyed;

(3) Restoration of the forest soil and roads.

Assuming that the forest capital has been encroached upon to the extent of three possibilities, then, in order to reconstitute it in 15 years, production must be diminished by 3/15 or 20 per cent. The more accessible blocks of forest have, however, been much more heavily overcut and should be managed with the utmost economy. Less accessible areas, particularly in the mountains, have been little touched and a task of the first urgency is to complete the network of forest roads and mountain cable ways so as to make possible the full exploitation of such areas. The work of reafforestation is necessary wherever the forest cover has been destroyed, and this work must be additional to the general programme of afforestation which is concerned with about 2 million hectares of heath and wasteland unsuitable for cultivation or pasture. A Central Committee of Reafforestion has been set up and is engaged in making a census of the land to be reafforested. Other Government ordinances deal with the restoration of the forests of the Landes, repair of the drainage system, reafforestation, fire protection, etc.

The forest estate consists of 4 million hectares of public (State and communal) forests administered by the departement des Eaux et Forêts, and 6¾ million hectares of private forest subject to no regulation. The writer outlines the minimum degree of control which he considers necessary and desirable for the proper management of privately owned forests.

Forest industry is split up among a great number of small logging and sawmilling enterprises, which have not the equipment or labour necessary for proper grading and handling of their products, and the number of which causes confusion and instability on the timber market. It is urgently necessary to produce some degree of unity in the timber industry, at any rate for the standard categories, and to this end it is necessary to create central organizations with three objectives:—

(1) To facilitate the satisfaction of the needs of public services by means of requisitioning (the proportion of the needs of the country to be met by each enterprise to be fixed for each category of forest products);

(2) To improve the marketing and grading of forest products;

(3) To regulate the timber market by buying excess production in times of slump, and throwing accumulated stocks on the market in case of increased demand.

It is therefore proposed to set up immediately a purchasing organization which should be the sole receiver of all timber requisitioned for the public service. Producers would deal only with this organization, which would control both quantity and quality of requisitions, ensure payment to the producers and direct delivery of the products. On the other hand, the public services would deal only with this service and would receive their supplies with much greater regularity.

Later, the producers of each district would be grouped in selling co-operatives which could organize depôts for finished goods such as sawn timber, where the wood would be graded, seasoned, and marketed.

In spite of all possible measures, large-scale imports especially of sawn softwoods and pulpwood are indispensable to French recovery. The following table is made on the assumption of a reconstruction programme spread over a period of 10 years.

used for feeding livestock. Damage to the forests due to the war was confined to certain regions, particularly in the north. On the whole there has not been over-exploitation. The cutting of firewood was executed so as to remove only the inferior trees. It is hoped to increase production by 50 per cent. in the next few years.

The Government shoulders half the expense of cultivation for private forest owners, and the owner is bound to employ 2 per cent. of the

General Plan of Imports for 1946

	Expected French production	*National needs*	*Deficit to be covered by imports*
Sawn softwoods (cu.m.)	1,700,000	5,500,000	3,800,000
Sawn hardwoods (cu.m.)	720,000	1,500,000	780,000
Sleepers (pieces)	5,500,000	7,000,000	1,500,000
Stavewood (cu.m.)	20,000	50,000	30,000
Telegraph poles (pieces)	400,000	1,000,000	600,000
Pulpwood (stacked cu.m.)	400,000	1,000,000	600,000
Wood for tannin extraction (stacked cu.m.)	300,000	500,000	200,000
Bark (metric tons)	8,000	45,000	37,000
Logs for cutting up into firewood	250,000	300,000	50,000
Exotic woods (cu.m.)	80,000	100,000	20,000

French forest production also suffers from a serious lack of mechanical equipment. The industry was ill equipped even before the war, and it is estimated that, since 1939, some 9,000 lorries and tractors (or 45 per cent.) and 12,000 horses (or 25 per cent.) have disappeared. A mission is to be sent to the United States to try to obtain equipment for the industry.

90 (481) : 09.7 : 98. Fjelstad, A. La situation forestière et ses problèmes en Norvège. **[The forest situation and its problems in Norway.]** *For. québec.* 11, 1946 (67–9, 71). [F.] [2157].

Report presented to the F.A.O. Conference at Quebec in October, 1945.

About 23 per cent. of the total area of Norway is forest. About 14 per cent. of the forest is owned by the State and 65 per cent. by farmers. The forests consist mostly of softwoods, especially Norway Spruce with Pine in the second place. Hardwoods are imported. Before the war, the annual cut did not exceed the annual increment. In 1939 exports of pulpwood, cellulose and pulp amounted to 1,100,000 metric tons, the cellulose being used mainly for the manufacture of artificial silk. During the war the forests provided firewood and fuel for transport. 250,000 metric tons of cellulose was revenue from sales in the cultivation of his forest. Practically the whole Norwegian forest is insured against fire by a mutual insurance association of forest owners. During the next 10 years it is proposed to reafforest all the forest territory destroyed by the Germans. Every year 50,000 acres of decayed forest will be cleaned and replanted. Hitherto unforested areas in the west of the country will be afforested, and the building of roads will make possible exploitation of forests remote from waterways and railways. Another important task is the elimination of forest grazing.

90 (489). Lorenzen, P. La situation forestière et ses problèmes en Danemark. **[The forest situation and its problems in Denmark.]** *For. québec.* 11, 1946 (57–8). [F.] [2158].

The area of forest in Denmark amounts to only 9 per cent. of the surface of the country, compared with an average of 30 per cent. for Europe as a whole, and this has led to the practice of very intensive silvicultural methods. During the war, the Forestry Association has concentrated on tree breeding, particularly with Larch and Ash. Denmark is, and will for long be, a timber-importing country. There is much need of mechanical transport, tractors, and mechanical saws.

90 (495) : 09.7. Laverdos, A. La situation forestière et ses problèmes en Grèce. **[The forest situation and its problems in Greece.]** *For. québec.* 11, 1946 (58–9). [F.] [2159].

The report presented by the Head of the Economic Research Service in Greece to the F.A.O. Conference at Quebec in October, 1945.

The total area of Greece, including mainland and islands, is 13 million hectares, of which 2 million hectares are forest (1,200,000 ha. public forest and 800,000 private). Before the war Greece imported considerable quantities of forest products, especially constructional timber and pulp. The destruction of Greek forests goes back to a very early date, was greatly accelerated during the War of Independence, and is estimated to be proceeding at a rate of 20,000 ha. per annum. During the late war 400,000 ha. of forest were destroyed by the enemy. In Attica, for example, all the forest except that on the summits of Parnassus has been destroyed.

90 (51). Fu, H. K. La situation forestière et ses problèmes en Chine. **[The forest situation and its problems in China.]** *For. québec.* 10, 1945 (415–8). [F.] [Soil Conservation Station, Tien Shui, China.] [2160].

The report on forest conditions in China, presented to the F.A.O. Conference at Quebec in October 1945 by the Director of the Soil Conservation Station at Tien Shui.

Reafforestation is the greatest task in the domain of forestry in China. It is estimated that 40 per cent. of the total surface of the country, or 1,721,700 sq. miles of land unsuitable for agriculture, ought to be used for forest production. Part of this area, where rainfall is abundant, could be regenerated naturally if it received sufficient protection, but the greater part of the deforested lands should be reafforested in order to speed up the establishment of forest cover. Since 1930 the Government has required that each district or county should establish a nursery to raise plants for distribution to the people, and since 1943 every village in some provinces is required to establish such a nursery. In some provinces every individual is required to plant one to five trees a year, according to the land available.

Only 229,800,000 acres, or 8·4 per cent. of the total surface of China is forest. During the war the Forestry Bureau made a topographical reconnaissance of 67,475,300 acres and demarcated 8 natural forest areas covering a total of 55,425,000 acres with an estimated volume of about 44,680,357,000 cu. ft. of wood. The forest administration is already at work in these areas.

For many centuries the main source of wood in China has been the farm woodlots. In the more hilly regions, such as the south of the Yangtze Valley, the farmers have commonly planted the Chinese Fir (*Cunninghamia lanceolata*) on the slopes after previously raising crops on them. Plantations of this kind are plentiful in the provinces of Fukien, Hunan, Kweichow, etc. Apart from Firs, the species most grown on farms is Bamboo, which is used for the manufacture of furniture and all manner of domestic utensils, besides being an essential material for paper making. During the war a great part of the farm woodland has been destroyed or greatly over-exploited for firewood.

The first Forest Law was promulgated in 1932 and came into force early in 1934. Since then, several supplementary regulations have been adopted. Before the war, forest research was carried out at the National Bureau of Forestry and Rehabilitation. There are 10 universities and colleges which give courses in forestry and in 1943 there were 345 students and 77 teachers of forestry. Some of the most pressing needs in order to carry out a programme of afforestation and utilization, are an increase in means of transport, provision of modern equipment for exploitation, and the establishment of sawmills.

90 (54). Howard, Sir H. La situation forestière et ses problèmes aux Indes. **[The forest situation and its problems in India.]** *For. québec.* 11, 1946 (61–7). [F.] [2161].

The report presented to the F.A.O. Conference at Quebec in October, 1945.

The forest domain of the Government of British India is about 100,000 sq. miles out of a total area of 800,000 sq. miles, or more precisely 13 per cent. There are also nearly 50,000 sq. miles of private forest, but this is rapidly disappearing. The essential points of the Government's forest policy may be summed up as follows: (1) Conservation of forests which influence physical conditions and climate.

(2) Conservation of forests necessary for the general needs of the country. When these minimum conditions are satisfied, then (3) agriculture has precedence of forestry, and (4) the local population is provided with forest products free or at very low prices; (5) when the preceding 4 points have been provided for, then only is it permitted to practise forest exploitation proportional to the yield.

With the exception of Teak, which comes from Burma, imports of all other species do not exceed 2 per cent. There are practically no exports. It is believed that it will be possible to meet increasing urban consumption by an increase in production. The best stocked forests, the result of the last 80 years of administration, will not be exploited for another 20 years. There has, however, been considerable over-cutting during the war, which will produce a scarcity for the next 10 years, and entails a thorough revision of working plans.

India, however, is not an urban, but a rural country, with 400 million peasants. In Northern India, from Karachi to Calcutta (1,500 miles) and from the Deccan to Peshawar (1,000 miles) there are millions of villagers who get nothing from the distant forests: they are extremely poor, have no timber for building houses, burn cow-dung for lack of other fuel, and so still further impoverish the soil. Almost the whole of India suffers from erosion, from floods and from droughts. A great part of these evils could be avoided by the restoration of the ancient forests. The necessary land for this reafforestation exists and in the right places. About 144,000 sq. miles of British India are cultivable. Another 144,000 sq. miles are classified as waste though a great deal could be used for the production of firewood and is in fact the degraded remains of jungle. The definite objective is to afforest 50–100,000 sq. miles either by closure to nomadic herds or by reafforestation or a combination of the two, in the next 25–50 years. Plans for the execution of this programme are in hand.

90 (54) : 81. Gulwadi, S. V. **Post-war reconstruction and our forests.** *Indian For.* 71, 1945 (342–5). [2162].

The writer believes that, contrary to the general impression, the war has brought certain indirect benefits to Indian forests. Before the war, because supplies of Teak were plentiful and fairly cheap, it was usual to specify Teak for every constructional use, whether permanent or temporary, with the result that the forests were becoming overcrowded with less valuable species at the expense of Teak. The war has provided an opportunity, through the cutting off of Burmese supplies of Teak, of felling some of the superfluous trees to make room for more valuable species. Owing to heavy demands for and short supplies of timber generally, uses have been found for hitherto untried jungle species. Timbers which will probably remain in use are *Terminalia tomentosa* for railway sleepers, *Bombax malabaricum* for matchwood, *Adina cordifolia* and *Stephegyne parviflora* for textile requisites, also species such as *Terminalia paniculata*, *T. belerica*, *Machilus macrantha*, for which there was formerly no demand. A great impetus has also been given to forest industries such as the manufacture of plywood, pulp and paper, collection of raw rubber from *Cryptostegia grandiflora* and the preparation of charcoal fit for use in gas-producer plants.

As the whole trend of post-war reconstruction is towards the industrialization of India, the aim of the working-plans officer should be to encourage plantations of species likely to be useful in the development of big industries such as those of plywood, pulp, raw rubber, etc.

He proposes a period of 5 years during which there should be no exploitation beyond the bare minimum necessary, a complete enumeration of the stock of valuable timber (especially Teak), new working plans to suit the actual conditions then arrived at, permanent restriction of Teak exploitation to the minimum (e.g. now that other species have been found suitable for railway sleepers, the quota of Teak sleepers supplied by the Forest Department should be curtailed). Many of the new sawmills should be closed down, retaining only those that would utilize solely the lop and top from normal fellings. A greatly increased planting programme and better tending of existing plantations are the other requisites for restoring the situation, and these call for greatly enlarged staff and better pay and conditions for forest workers.

90 (54.5) : 33.06 : 23.3. Hamilton, A. P. F. **Minor forests, village forests and firewood. (Extract from a note on a tour in Bombay Province.)** *Indian For.* 71, 1945 (409–10). [2163].

The writer reviews the possibilities of firewood provision by village and community forests and concludes that they can meet the demands only to a small extent. Government afforestation of waste land might also partly supply the need. But the mass of poor cultivators must have their firewood free, must be able to get it as they want it, and it must be within easy reach. The writer considers that the ultimate solution lies in the cultivator growing his own firewood on the borders of his fields, on the little patches of waste ground, along the banks of streams, etc. This must, however, be integrated in a wide policy of firewood and charcoal production for towns, industries, and consumers other than cultivators; for unless cheap fuel is available to consumers of this class, the cultivator will be tempted by high prices to sell his firewood and continue using cowdung.

90 (68). VILJOEN, O. R. La situation forestière et ses problèmes en Afrique-du-Sud. **[The forest situation and its problems in South Africa.]** *For. québec.* 11, 1946 (51–5). [F.] [2164].

The report presented by the High Commissioner for South Africa in Canada to the F.A.O. Conference at Quebec in October, 1945.

The present area of forest under the control of the Forest Service is 6 million acres, and it is hoped to increase it in future. The Forest Service can, if it sees fit, forbid felling and burning in this area. Of this 6 million acres, 3½ million are under the jurisdiction of the Forest Service, but only 1 million are actually worked as State forests, the rest being maintained for protective purposes on mountains and catchment areas. Private enterprise has accomplished little in the matter of forestry, and the Government, in addition to its own planting programme, intends to encourage private persons to plant trees both for the production of timber and firewood and as windbreaks. Exploitation of State forests during the war forced the Forest Service also to enter the field of sawmilling and their opinion is that the products of State plantations should continue to be dealt with in State sawmills.

90 (68.9). NYASALAND. **Interim report No. 6: forestry.** Post-war Development Committee, Nyasaland Protectorate. 1944. pp. 6. [2165].

About 9·05 per cent. of the total land area of the Nyasaland protectorate is now contained in forest reserves, demarcated village forests, closed hill slopes, and the protected banks of streams. Other woodlands, in waterless and unoccupied country and on private estates are estimated to be about 7–8 per cent. of the total land area. The great bulk of the requirements of the native population is for short poles for hut building, but their demand for sawtimber will inevitably increase with higher standards of living, and the main problem of forestry is to meet this growing demand for durable sawtimber instead of poles. The forests are mainly woodland and savanna types, and for the most part composed of small trees, of which only a few species provide durable timbers. To a great extent the poor quality of the woodlands is due to the long dry season, but periodic fires and soil erosion due to shifting cultivation have also played their part. It is recommended that the intensive method of plantations and the extensive method of improving natural woodlands should both be developed in demarcated lands kept for sylvan development. The protected strips along stream banks are particularly suitable for development to increase sawtimber. In Nyasaland, intensive forestry for the production of sawtimber has the best chance of success on evergreen sites, which are also soundest from the economic point of view. The recommended objective of Native forestry is the bringing under intensive management of 16,500 acres within 10 years. *Eucalyptus* grows well in the Shire Highlands, and many estate owners have established plantations; but many of these are stagnant for lack of thinning and often damaged by fires, while in some cases suppression has gone so far that felling and a fresh start are needed.

90 (71). ROBINSON, SIR R. **Comments from Britain on the 'Wallace' Report.** *Timber of Canada* 6 (4), 1945 (39–41, 70). [2166].

Comments by the Chairman of the British Forestry Commission on the Final Report of the Canadian Sub-Committee on Conservation and Development of Natural Resources and the Report on Forests and Forest Industries. Sir Roy Robinson finds himself in general agreement with the reports. He urges the importance of giving both the Dominion and Provincial Forest Services a status in government machinery commensurate with the importance of their functions, and suggests that an attempt should be made to set up Dominion and Provincial 'targets' which would be the main objectives of Forest Policy. For example, how long is it expected to take, to get the whole 275 million acres of forest under management? What would be a fair area to aim at 5, 10, 20, etc. years after the end of the war? What would be the corresponding Provincial quotas? Procedure on such lines gives to current work a reality which is lacking when policy is stated in general terms only, and publication of the relative figures keeps the country and Parliament informed as to progress.

90 (71) : 98 : 09.4 : 33. CAMERON, D. R. La situation forestière et ses problèmes au Canada. **[The forest situation and its problems in Canada.]** *For. québec.* 11, 1946 (45–8). [F.] [2167].

The report presented by the head of the Forest Service to the F.A.O. Conference at Quebec in October, 1945.

Canada, with a population of 12 millions, occupies the third place among the nations of the world for forest products, and first place as exporter of industrial forest products. The forest area is more than 781 million acres, or 58 per cent. of the Dominion. Of these, 493 million acres are productive, but only 275 million acres are at present accessible for commercial operations. The volume of merchantable wood is estimated at 190,000 million cu. ft. of which 33 per cent. is Spruce, 17 per cent. Pine, 23 per cent. other softwoods, and 27 per cent. hardwoods. More than 90 per cent. of the forests belong to the Crown and are administered by the provincial governments. Felling licences over about 111 million acres have been conceded to corporations and private persons, for varying periods, but the land is still the property of the crown. Private forests comprise about 57,400,000 acres, of which 23 million acres are farm woodland.

From 1932 to 1940 the average annual cut was 2,150 million cu. ft. made up as follows: sawlogs, 34 per cent.; pulpwood, 31 per cent.; firewood, 31 per cent.; other products, 5 per cent. During the same period, loss from fire, insects and disease amounted to 880 million cu. ft. annually, which brings the total annual drain to 3,030 million cu. ft., of which 71 per cent. was utilized and 29 per cent. destroyed. This figure does not appear considerable when compared with the volume of standing timber or the accessible forest area, but forest operations tend to be concentrated in the most accessible regions and it is doubtful whether the mean annual increment in these places is more than the 11 cu. ft. per acre necessary to replace the annual drain. With better methods of exploitation, however, Canada should eventually be able to feed forest industries 2 or 3 times as great as the present ones. On favourable sites, mean increment amounts to 30 or 40 cu. ft.

There are 106 pulp and paper mills and more than 5,000 sawmills. The forest and its industries employ a labour force of 260,000 men per year, but since much of the work is seasonal, the work is shared among a much larger number of persons. Wages amount to $350 million per year, and the invested capital is about $1,300 million. Farm woodlands furnish about 30 per cent. of the annual cut, and the sale of forest products makes a substantial contribution to the farmer's income, while seasonal work in forests and forest industries is a source of income in the winter months.

The principal forest problem in Canada is improving protection against fire, insects and disease. The development of the system of forest roads is essential both for fire protection and for future exploitation. Exploitation is carried on almost without regard to regeneration, though some provincial governments require that operations shall follow an approved plan, and several large companies work on a system of sustained yield. Much further research is necessary in this matter.

90 (729). STOCKDALE, SIR F. **Development and welfare in the West Indies, 1940–42.** H.M. Stationery Office, London. 1943. pp. iv + 93. [2168].

90 (73). WATTS, L. F. La situation forèstière et ses problèmes aux États-Unis. **[The forest situation and its problems in the United States.]** *For. québec.* 10, 1945 (406–10). [F.] [U.S. Forest Service.] [2169].

The report on forest conditions in the United States, presented to the F.A.O. Conference at Quebec in October, 1945 by the head of the U.S. Forest Service. It is believed that the economic expansion which is being planned in the United States will require an annual production of 21,500 million cu. ft., which is 5,000 million cu. ft. more than the annual production during the war. In 1909, when the first tentative national inventory was made, the standing timber was estimated at 2,826,000 million bd. ft. In 1938 this had dwindled to 1,764,000 million bd. ft., a reduction of 37 per cent. in 30 years. Three-quarters of the forested area is situated east of the Great Plains, but it produces only one-third of the national output of sawlogs. There is less sawtimber in the whole of the East than in the Douglas Fir region of Oregon and Washington. The average volume per acre of forest ~~is~~ about 1,600 bd. ft., which is less than half the estimated pre-war volume per acre in Germany. Even in the North-West Pacific region, which contains the whole of the surviving virgin forest, the mills which deal with 60 per cent. of the present cut in Washington and Oregon have private reserves of wood for only 15 years. Some of them could subsist for a few years longer on the public forests, but shortage of wood will inevitably force many mills to close down within the next few years.

The problem which has to be faced is not one of lack of space. The 462 million acres of commercial forest could produce all the wood needed, without encroaching on forest devoted to recreation or conservation of catchment areas, if it were properly managed. As it is, more than 70 million acres are practically deforested as a result of fires and over-exploitation. Much of the remainder is only partially stocked and produces less than half its normal yield. Three-quarters of the area of commercial forest is privately owned and produces one-fifth of the annual national production. The public forests are mostly situated in the mountainous regions of the west, which are generally less productive and less accessible than the private forests. Of the 158 million acres of national forest (excluding Alaska) less than one-half is commercial forest. The communal and State forests together amount to less than 25 million acres.

Much progress has been made in the protection and management of the public forests, but, with some small exceptions in a few states, the public exercises no control over cutting on private land. Commercial operations usually take the form of clear cutting and very large quantities of wood are left in the forests. The federal government co-operates with state governments for fire protection, and in 1944 the protection organization covered 297 million acres of private forest, but about one-third of the area of private forest is still unprotected. Help and advice are also given to farmers for improving their woodlots. The Forest Service believes, however, that the educative method is too slow and that the federal government ought to establish standards of forest management and cutting practice, give financial support to States which pass legislation for this purpose, and itself regulate the matter in States which fail to do so.

90 (91.4). Dacanay, P. **Progress of reforestation in the Philippines.** *Rev. int. du Bois* 13, 1946 (9–14). [E.] [Division of Forest Study and Research, Bureau of Forestry.] [2170].

A general account of the work of the Philippine Bureau of Forestry since its establishment in 1909, and of the projects now in hand.

90 (91.4) : 98 : 09.7. Ruiz, L. T. La situation forestière et ses problèmes aux Philippines. **[The forest situation and its problems in the Philippines.]** *For. québec.* 11, 1946 (71–3). [F.] [2171].

Report presented to the F.A.O. Conference at Quebec in October, 1945.

The commercial forests of the Philippines cover almost 47 per cent. of the total land area. The volume of merchantable timber is estimated at about 464,740,000 bd. ft. They are mostly virgin forest and before the war only a little more than 1,000 million bd. ft. per annum was cut. About 75 per cent. of the growing stock and 90 per cent. of its volume consists of 'Lauan' (various Dipterocarpaceae, especially *Shorea* spp. which are well suited for cabinet work and were much exported to Japan and the United States). In 1939 the timber industry occupied 4th place among the important industries. The 3,874 establishments had total assets of $18,451,000 and employed 70,000 men. In 1940 there were 148 sawmills with a total daily capacity of about 1,153,000 bd. ft. There were also 15 lumbering organizations with a total daily production of 237,000 bd. ft. The average annual production of wood for the period 1936–40 was 1,027,274,000 bd. ft. of which 80 per cent. was for home consumption and 20 per cent. for export. Almost all the forests are owned and administered by the State.

It is believed that almost all the sawmills and lumbering organizations have been destroyed during the war and there is consequently a great scarcity of timber for reconstruction.

90 (945) : 91.5. **Victoria's forestry plan.** *Wood* 11, 1946 (36–9). [2172].

The state of Victoria has an area of 88,000 sq. miles, 20 million acres of which are under forest; 5 million acres are reserved forest, 5 million acres private property, and the remaining 10 million acres timber-bearing unreserved crown land. The State Forestry Commission has a programme of intensive forest preservation and management for the next 10 years. Development of this plan, which is to combine State planning with private enterprise, may take 20 years to complete and will open up reserved forest and unreserved crown land estimated to yield 6,000 million super. ft. of merchantable timber.

In the past Victoria has suffered greatly from bush fires. The 1939 fires killed 2,000 million super. ft. of timber, of which a half has since been salvaged. The average Eucalypt forest takes 40 years to re-grow. The forests are mainly hardwoods (principally Eucalypts) but there are some 50,000 acres of Pine plantations in the north and north-west of the State.

Under the new forestry programme, mills and other forest-products industries will eventually be centred in 'timber townships' instead of being scattered through the forests as at present. In the townships will be concentrated workers engaged in making forest roads, doing silvicultural work and reafforesting cut-over areas. Such communities will avoid exposure of small groups of workers and their families to the dangers of fire, will provide a readily available pool of fire-fighters, and prevent pollution of catchment areas. Surveys, fire control, water conservation and road building are major items in the programme.

91. SOCIAL AND ECONOMIC SIGNIFICANCE OF THE FOREST

91.1. *Rural Preservation. Reserves. National Parks*

91.1 (41.1–4). GREAT BRITAIN. **Forestry Commission: Report of the National Forest Park Committee (Glentrool), 1943.** H.M. Stationery Office, London. 1945. pp. 6 + map. [2173].

The report of a committee set up to advise the Forestry Commission on steps to be taken to form a National Forest Park on their Glentrool property in S.W. Scotland. The committee recommend the establishment of a National Forest Park and also make various detailed recommendations. Footpaths through the plantations should be left so that walkers can go two abreast even when the trees are full grown. Such paths and rides should be diagonal or zigzag or follow contours rather than run straight up and down the hill face. Some paths may have to be closed to the public during certain seasons of the year when fire hazard is high, and information of this nature should be given all possible publicity. Special attention should be paid to amenity in laying out plantations. Long straight fence lines should be avoided as far as is practicable; good viewpoints should be left unplanted; mixtures of species should be used for scenic effect; small plantings might be made by lochsides even when uneconomic. The Oak woods between Buchan and Glenhead and the coppicewood at Culdons should be regarded as ecological reserves.

91.1 (42.1–8). GREAT BRITAIN. **Forestry Commission: Report of the National Forest Park Committee (Hardknott), 1944.** H.M. Stationery Office, London. 1945. pp. 7. [2174].

The Forestry Commission have agreed that part of their Hardknott Forest area in Eskdale shall be included in a National Forest Park. This is the report of a committee appointed to advise them on the steps necessary for utilizing the area as a National Forest Park. It recommends that special attention should be paid to amenity, including such matters as planting of species which will give the greatest possible natural effect consistent with good forestry; avoidance of hard outline edges to plantations, which should follow natural contours as much as possible; leaving unplanted the view points and as much of the surrounding land as will enable the view to be enjoyed when the trees are grown; protecting the sky lines by not planting too close to them; leaving the rock formations and banks of streams free of trees.

91.3. *Influence of the Forest on the Environment*

91.3 : 11.1 : 11.2 : 11.62.11. FAIRBAIRN, W. A. **Climate and physical conditions in relation to forestry.** *Farm and Forest* 6 (2), 1945 (109–10). [2175].

The writer briefly reviews the present state of knowledge about the effect of vegetation on climate and concludes that the primary considerations in a forest policy for any area should be to protect or reserve the area of woodland necessary to maintain a natural climatic balance, to conserve the fertility of the soil, to protect the land from the ravages of man, and to restrict accelerated soil erosion.

91.3 : 11.47.6 : 24.4. SAUSMAN, V. A. N. **Land improvement and forests.** *Indian For.* 71, 1945 (336–42). [Southern Circle, Bombay. Paper read at the 6th Silvicultural Conference, Dehra Dun, 1945.] [2176].

A general account of the problems of soil erosion and conservation, laying stress on the importance of forest cover for conserving the soil. After dealing in general terms with the various types of natural forest, the writer urges the desirability of establishing farm or village forests on eroded submarginal crop and pasture lands. The many millions of privately owned acres of such land in India should have a tree cover both in their own interest and for the benefit of lands further downstream. This can be accomplished if it can be demonstrated to farmers that forestry on the farm is a paying proposition, both for the income from forest products and for the beneficial effects of the tree cover in conserving and improving the soil and acting as a windbreak. Experiments show that trees with the lower bole clean are dangerous to field crops because they give rise to air currents. Trees which branch heavily from low down are the most effective for shelter purposes. Taking everything into consideration, trees which propagate by root suckers are the most suited for farm forests because they form a dense screen against the wind, replace wastage by removal for fuel at a quicker rate than trees which propagate by other methods and by the spread of suckers help in soil formation.

91.5. *Value of the Forest for Colonization*

91.5 (47.1) : 92 : 94.3. MARGELIN, R. Finska skogsproblem. Kolonisationens inverkan på skogarna. [**Finnish forest problems. The influence of colonization upon the forests.**] *Skogsägaren* 21, 1945 (228–9). [Sw.] [2177].

Under the new colonization law, designed to secure land for agriculturists who have lost their property through the war, front-line soldiers, etc., an agricultural holding is to have sufficient forest to produce timber for sale as well as for domestic use. Where insufficient forest exists for individual ownership, it is intended to form a special type of communal forest serving several farms. A farm established under the scheme may have up to 15 ha. of agricultural land, plus forest sufficient to yield 75–125 cu.m. annually, of which 50–60 per cent. is reckoned as available for sale. The programme is estimated to require about $1\frac{1}{2}$ million ha. of forest, or 6 per cent. of the forest area, but in southern Finland, which will be most affected, about 20 per cent. of the forest area will be needed. The forest will be taken from State land and from neglectful owners (communal or otherwise), from owners whose main income is not from agriculture, and only as a last resort from agricultural land proper. In case of need, a peasant forest property may be deprived of as much forest as would leave the equivalent for the same property considered as a colonization farm. It is believed that the execution of these measures will require great judgment to avoid destructive effects.

91.8. *The Forest as a Source of Employment and Income*

91.8 (410) : 8. GREAT BRITAIN. **Forestry: a detailed description of qualifications, training and prospects of employment.** *Careers for Men and Women Series* No. 21, 1945. pp. 8. Ministry of Labour and National Service, St. James's Square, London, S.W.1. [2178].

One of a series of pamphlets compiled by the Appointments Department of the Ministry of Labour. It deals with pre-entry qualifications, training at the Universities (with fees), concessions to ex-service entrants, and opportunities of employment in Great Britain and the Colonies.

92. FOREST LAW

92 (410). WALMSLEY, R. C. **Amenity belt of trees along public highway: landowner's liability to the public.** *J. Land Agents' Soc.* 45, 1946 (12–3). [2179].

A résumé of a judgment given in the King's Bench Division of the High Court in November, 1945, which laid down the liability of a landowner for accidents arising from windthrow of roadside trees, resulting from the removal of woodland on their windward side.

92 (44) : 97.1. RANDET, P. La protection et l'extension des surfaces boisées. [**The protection and extension of forest areas.**] *Rev. Eaux For.* 83, 1945 (381–96). [F.] [2180].

The article gives a résumé of French forest law, and town-planning legislation in so far as it affects forestry practice. Decrees of the Vichy government during the occupation are included in the survey.

92 (485) : 94.3. BRAUNSTEIN, Å. Om rätten att förvärva jordbruksfastighet. En översikt av de nya lagbestämmelserna. [**On the right to acquire agricultural property. A review of the new legal prescriptions.**] *Skogen* 33, 1946 (28–9). [Sw.] [2181].

A law, coming into force on 1 January, 1946, and designed to prevent speculation in agricultural properties in Sweden, subjects the sale or exchange of such properties, including forest land proper, to State control, provided that their taxable value exceeds 5,000 kr. Only the State and communes are exempt from the provisions. Land acquired for purposes other than agriculture and forestry is also excluded from such control. Persons acquiring land which they intend to manage themselves for agriculture or forestry, whether as a complete property or as extensions to a small holding, can obtain the necessary permission direct from local authorities by affidavit of their status and intentions with evidence of their reliability. Other persons must apply in writing, stating their case in detail, to the Department of Agriculture. A sale is invalidated if such permission is not obtained within 3 months of an agreement between owner and buyer. The law is valid until 31 December, 1948.

92 (494) : 23.23.1 : 23.24.1. Verfügung betreffend die Gewinnung und Verwendung von Waldsamen und -pflanzen. [**Decree affecting the production and use of forest seeds and plants.**] *Schweiz. Z. Forstw.* 96, 1945 (222–3). [G.] [2182].

By a decree of 17 July, 1945 the Sektion für Holz des Kriegs-Industrie- und -Arbeits-Amt is to control forest seed and planting stock in Switzerland. Producers and dealers may be ordered to deliver to particular consumers, or consumers to accept material from a specified source. Dealers in forest seed must obtain permission to trade by applying to the Section, and may be required to furnish any particulars and to keep such records as are needed for the control and investigations that the Section is empowered to arrange. Order No. 1 of the Section, taking effect from 8 August, 1945, defines forest seed as that of Spruce, Silver Fir, Pine, Larch, Mountain Pine, Beech, Oak, Ash, Maple, Elm, Alder and Birch, and trade as the sale of seed for more than 200 Fr. per annum. Records of seed provenance must include the exact situation, altitude, aspect, soil conditions, and silvicultural details of the parent stand. In all stages of trade, from seed collection onwards, the seed must be labelled to show species, parent stand and year of collection. Dealers must provide full details of provenance on request. In all processes, mixing of different seed lots is forbidden. Book-keeping must be done according to the Section's specifications. [Cf. *For. Abstr.* 7 (No. 1602).]

92 : 60.31 (73). WIESEHUEGEL, E. G. **Forest regulation through statutory allocation of cut.** *J. For.* 43, 1945 (715–7). [Forestry Relations Department, Tennessee Valley Authority, Norris, Tenn.] [2183].

Assuming the adoption of some form of federal regulation of forest practice, the writer outlines a plan for regulation based on the volume of cut rather than on silvicultural cutting practices. A total cut having been decided on for the whole country, a proportion would be allocated to regions or states for each of the major forest products, and these allocations would again be passed on to smaller administrative units. He believes that silviculturally sound cutting practices would necessarily follow this procedure.

93. FOREST RIGHTS, CONCESSIONS AND PRIVILEGES

93 (494) : 94.12 : 97.3. HUBER, A. Waldbesitzverhältnisse in den Freibergen. [**Forest ownership in the Freiberge.**] *Schweiz. Z. Forstw.* 96, 1945 (30–8 + plate). [G.] [2184].

The community of Bémont (Bernese Jura) has a total area of about 1,169 ha., of which 590 ha. is common land consisting for the most part of forest pasture in very open, uneven-aged, almost pure Spruce, in strong contrast to private land, where owing to protection of hardwoods and discouragement of conifers the former predominate. Every member of the commune has grazing rights, taxed according to head, kind and age of stock, on the common land, but such rights may be bought and sold. The present head of stock is believed to be as much as 100 per cent. in excess of the optimum. Timber rights are peculiar: the commune directly controls about 493 ha. with a stocking of 34,500 sv. and an annual increment of 726 sv., but the remainder, though common land for grazing, is divided as regards timber rights among (*a*) two corporations, corresponding to two former communities now merged into one, with rights on respectively 10 and 52 ha. from which timber may be cut and sold, but on which other measures (such as tree planting) are forbidden; and (*b*) private, individual timber rights of the same nature over a total of 24·5 ha. In the latter case the rights are exercised on a very large number of individual lots, often extremely small, which, as federal law does not recognize ownership of grazing and timber rights separately from that of the land, cannot be recorded in the land register. From the legal point of view the commune is the owner, though saving clauses allow the above practices as local usage. There is no official map of the right-holders' lots and the only unofficial one is seriously out of date, hence great confusion reigns about the boundaries of lots and the right-holders themselves are in favour of some settlement. Of the possible means of settlement the best, especially considering the legal ambiguity of the situation, would be the re-purchase of all rights by the commune.

93 (494) : 09.1. Reich, U. Die belasteten Alpwaldungen im Obertoggenburg. (Angaben über geschichtliche Entwicklung. und Rechtsverhältnisse). **[The encumbered Alp forests of Obertoggenburg. (Information on historical development and forest rights).]** *Schweiz. Z. Forstw.* 96, 1945 (73–83 + plate.) [G.] [2185].

A historical review of rights and ownership in these forests, which are defined as those encumbered with servitudes and rights of co-ownership vested in Alp corporations. There are in theory 4 categories: (i) the most frequent, where the commune is the landowner, and corporations hold rights of grazing and of cutting wood for their own requirements; (ii) similarly, but with Alp corporations as co-owners, e.g. having the right to share in returns from sales of wood; (iii) an Alp corporation is the landowner and the commune holds rights of woodcutting for local use [in practice this type is similar to (i)]; and (iv) one instance in which the Alp corporation is the absolute owner. Separation of pasturage and wood rights, preferably by dividing ownership of both land and rights between the bodies concerned, is desirable and has been effected to varying extents, as illustrated by a tabular statement of the present position. There is a good prospect of such adjustments continuing without recourse to legal contests.

93 (494) : 94.12. Blass, H. Die Ablösung der Holzungsgerechtigkeiten der Egg- und Wachtholz-Korporationen an der Waldung in der Horgener Egg. **[The dissolution of timber rights held by the Egg and Wachtholz corporations on the forest of the Horgener Egg.]** *Schweiz. Z. Forstw.* 96, 1945 (317–29). [G.] [2186].

A detailed account is given of the historical circumstances and legal proceedings leading to the dissolution of timber rights held by these two corporations on land owned by the commune of Horgen.

94. FOREST OWNERSHIP. CO-OPERATIVES

94.12. Reynolds, H. A. **Community forests.** *Ohio For. News* No. 42, 1945 (3–8). [Massachusetts Forest and Park Association, Boston, Mass.] [2187].

The town forest is rapidly becoming an accepted institution in the United States. 2,203 cities and towns now own community forests with an aggregate acreage of 2,873,762. This pamphlet details some of the advantages of this form of forest (recreation, amenity, game preservation, education, conservation and protection of the domestic water supply) and illustrates them by some account of the community forests in Massachusetts and the way in which they were established.

94.12 : 91.4 (73). **Community forests for rural people.** *Leafl. U.S. Dep. Agric.* No. 244, 1945. pp. 8. [2188].

Community forests have been established in many parts of the United States, usually at the instance of the 4-H Clubs. They are intended for recreation as well as demonstration of forestry practice, and give members of the clubs practice in forestry operations. Some account is given of 2 or 3 existing community forests, and suggestions made for the establishment of new ones.

94.3 : 67 : 95.2. HOWARD, SIR H. **[Letter on] post-war forestry.** With comments by J. H. Milne Home and S. Strang Steel. *Scot. For. J.* 59, 1945 (108–12). [2189].

A letter and comments dealing mainly with the practicability of long-term, low-interest Government loans to private landowners for such long-term projects as afforestation.

94.3 (47.1) : 06.1 : 94.4. RÄSÄNEN, K. A. Skogsägarnas föreningsverksamhet i Finland. **[The activities of forest owners' associations in Finland.]** *Skogen* 33, 1946 (43–4). [Sw.] [2190].

A brief historical note on the Local Forestry Associations [cf. *For. Abstr.* 7 (No. 1485)].

94.4 (77.5) : 35 : 97.2. KELLER, J. W. **Wisconsin's co-op log yards.** *Soil Conserv.* 11, 1945–46 (107–9, 113). [2191].

The marketing of farm woodland products frequently presents an obstacle to carrying out soil conservation programmes. Where there are few local markets and a lack of understanding of scaling rules and grading methods, farmers are reluctant to spend time and effort in protecting and managing their woodlands. Soil Conservation Service workers in Dunn County, Wisconsin, where 20 per cent. of the farm area is woodland, deciding that something should be done to remedy this state of affairs, collaborated with the Farmers' Union to set up co-operative log-yards. The first of these was established in 1943 and there are now 22 of them in the State. The yard agency makes a charge per unit of product which ranges from $2.50 to $5 per thousand bd. ft. for handling logs. The farmer marks each log with his identification mark and makes delivery to the yard. When sufficient logs have been assembled for shipment, the co-op manager orders railway wagons, arranges for the purchasing company and the Soil Conservation Service to have representatives present to scale and grade, provides for loading, and attends to all other shipping details. Veneer logs have been the principal products. Farmers may deliver from one log to a carload of logs to the yard at any time during the year. The Soil Conservation Service also advises the farmers which trees to fell and instructs them in scaling methods, and finds this a good starting point for interesting them in soil conservation practices generally.

94.7 : 92 (494). HUBER, A. Zur Geschichte des Art. 26 im Eidg. Forstgesetz vom 11. Oktober 1902. **[The history of Art. 26 of the federal forest law of 11 October 1902.]** *Schweiz. Z. Forstw.* 96, 1945 (141–57). [G.] [2192].

This article, which was designed to encourage the consolidation of scattered lots of private forest under common management, with financial assistance from Federal funds and technical assistance from the Canton forest services, was practically ineffective, and only 4 corporations or companies were so formed. The chief reasons appear to be reluctance of the owners to surrender individual rights and insufficient State subsidies for the purpose. The history of the article, before and after its enactment, is reviewed. A revised version was officially approved in June, 1945, but has to stand for objections until October, 1945, before it can be put into effect. Under the revised provisions the Federal government would bear all costs of consolidation, while the Canton governments, which would have the power of ordering consolidation where necessary, would be responsible for legal detail, supervision of the process, and the direction, by their own forest services, of management. No dissolution of the forest into individual lots again would be possible without the consent of the Canton government. Provision is to be made in consolidation schemes for such transport facilities as are needed for development. If necessary, public forest could also be included in such schemes.

94.7 (494). GROSSMANN, H. Privatwaldzusammenlegungen. **[Consolidation of private forests.]** *Schweiz. Z. Forstw.* 96, 1945 (286–302). [G.] [2193].

Private forests in Switzerland total 279,000 ha. (28 per cent. of the forest area), 202,000 ha. being attached to agricultural properties. There is great variation not only in their percentage representation from canton to canton and district to district, but also in the degree of parcellation into scattered and often virtually unmanageable small lots. Articles of the Federal Forest Law of 1902 that refer to private forests are listed, and it is noted that Swiss forest policy has given greater attention to the more important communal forests. On the whole, management of the private forests is unsatisfactory owing to the owners' lack of knowledge and interest; the severe parcellation, which is particularly injurious where the lots are narrow strips liable to damage from action taken on neighbouring lots; speculation by non-resident owners; and in some regions the poor pay of individual foresters. Figures for the Canton of Zürich show that growing stock and yield are considerably lower than in communal and State forests. Instances of excessive parcellation are quoted and possible remedies for poor management are given as: education of owners, the indirect propaganda afforded by the good condition of State forests, the provision of a more centralized estate-forester service, and consolidation of holdings. The last measure is urgently needed in many districts, especially as a land-register survey is already under way. The possible types of consolidation are: (*a*) corporative, a desirable but rather unpopular solution whereby owners sink their rights and properties in a corporation of which they become shareholders; (*b*) the gathering together of owners' scattered lots so far as possible into one block per owner; (*c*) mere adjustment of boundaries and small exchanges of land, which is troublesome and scarcely worth while; (*d*) the formation of owners' associations, which would seldom lead to the management of the forest as one unit; and (*e*) buying-up of lots, a costly solution, especially if the previous owner liquidates his growing stock before sale. Notes are included on procedure with special reference to (*a*) and (*b*), the establishment of proper road networks, and costs. Federal subsidies up to 50 per cent. of costs (disregarding road systems, for which it is hoped that satisfactory subsidies may be sanctioned by a revision of the Forest Law) may be granted on condition that the Canton also contributes to costs. Savings may be made by consolidation in the costs of demarcation and surveying for the land register.

95. FOREST TAXATION. LOANS AND INSURANCE

95.1 (489). Bruun, P. Om Skovenes Skattepligt. **[On the tax liability of forests.]** *Dansk. Skovforen. Tidsskr.* [30?], 1945 (440–5). [Dan.] [2194].

Discussion of this subject is invited in connexion with impending legislation. It is suggested that for the larger forests increment might be a convenient basis, since it is fairly constant and hence it should be possible to eliminate the effect of large fluctuations of income whereby tax liability may be larger than that for the same total income evenly distributed over a period.

95.1 : 83 (494). Oberli, H. Die Besteuerung der Forstreservefonds. **[The taxation of the forest reserve funds.]** *Schweiz. Z. Forstw.* 96, 1945 (329–45). [G.] [2195].

The tax liability of forest reserve funds (consisting chiefly of returns from over-felling in public forests, in war-time or after natural catastrophes, set aside by law to be used for specified purposes only—e.g. equalization of financial returns, forest development, etc.) is discussed on the basis of legislation in St. Gallen. So long as the fund is not deducted from the value of the forest, double taxation results. To regularize the position, it is suggested that in periodical assessments of yield value, the reserve fund at the last working-plan revision should be added to the value of the forest as currently assessed, when the two taken together would in justice be liable to property tax, the accumulating funds in the interim periods being exempt.

96. POLICY REGARDING PROTECTION FOREST AND DEFORESTATION

96 (494). Hess, E. Die Wiederherstellung des Schweizer Waldes. **[The rehabilitation of Swiss forests.]** *Schweiz. Z. Forstw.* 97, 1946 (3–16). [G.f.] [2196].

The war-time losses that must ultimately be made good are: (i) a diminution of the forest area by 12,000 ha. as a result of clear fellings, which should be restored by afforestation of submarginal land in catchments in the protection-forest zone. (ii) The actual growing stock liquidated by the clear fellings, which could be replaced by doubling the growing stock on 20,000 ha. of poorly stocked mountain forest. (iii) Excess fellings in existing forests, which should be restored by confining the annual yield to 80 per cent. of the normal, by conversion of pure Spruce to hardwoods with their natural associates, and by conversion of coppice to high forest.

Federal law requires that afforestation be done to compensate for clear fellings, and allows for a supplementary subsidy of 25 per cent. of costs for such work. Assuming the necessary work to be spread over 30 years in cases (i) and (ii), and over 20 years in case (iii) the total cost to the Federation is estimated at about 4 million francs per annum. To this should be added the 400,000 fr. p.a. that will continue to be necessary to subsidize the normal programme of afforestation and protective works. The Federation should make financial aid dependent upon the provision of suitable subsidies by the Cantons. The total figure of 4·4 million francs is regarded as entirely reasonable compensation for legal restrictions on forestry in the general interest.

96 (494) : 98. GONET, C. Perspectives d'avenir. **[Future prospects.]** *Schweiz. Z. Forstw.* 97, 1946 (17–24). [F.g.] [2197].

The primary object of forest policy in Switzerland must now be to secure compensation for war-time inroads upon the forests, to which end fellings must be reduced and afforestation and conversion projects carried out. The necessary sacrifices cannot be made without State assistance, and the State has a special obligation in that by controlling timber prices it has prevented the building-up of reserves for post-war tasks. It is urged that the rehabilitation of all over-exploited forests must be of concern to the State.

For some time to come, timber consumption is likely to exceed the pre-war average, but the demand for timber in the combatant countries is so large and urgent that no increase of imports can be expected at present. Reduction of fellings in Switzerland will thus be extremely difficult, but the author suggests that if timber prices were increased, owners would have a greater incentive for good management to increase yields, and buyers would be more economical in the use of dearer timber.

97. POLICY REGARDING THE RELATION OF THE FOREST TO AGRICULTURE, PASTURE, AND INDUSTRY

97.1 (42.1–8) : 23.3 : 21.0. GARDINER, R. **England herself.** Faber and Faber Ltd., 24 Russell Square, London. 1944. pp. 185 + plates + map. Price 8*s*. 6*d*. [2198].

The book describes the work of reconstruction on an agricultural estate in Wessex, which was developed out of a semi-derelict countryside in the period between the two wars. The chapter on forestry is a reprint of an article in the *Quarterly Journal of Forestry* [cf. *For. Abstr.* 4 (227)]. The author contends that the forestry, agriculture and rural activities of a district should be co-ordinated in co-operative estates each based on the manor. The needs of farms and rural industries for timber can be met from a plenitude of woods, belts and spinneys which are easily managed by a landowner with a trained woodlands staff, but are very expensive to administer departmentally. The planting of vast blocks of commercial forests on a national plan for creating national timber reserves or for other reasons is justifiable; but much of this work could be delegated to properly organized estates, which would ensure that agricultural needs were succoured, not violated.

97.1 (67.6) : 06.6. **The Kikuyu lands. The relationship of population to the land in South Nyeri,** by N. Humphrey. **Thoughts on the foundations of future prosperity in the Kikuyu lands,** by N. Humphrey. **Memorandum on policy in regard to land tenure in the native lands,** by H. E. Lambert and P. Wyn Harris. Govt. Printer, Nairobi, Kenya. 1945. pp. 68. [2199].

This pamphlet contains three memoranda on the fundamental issue of land conservation. Great stress is laid on the need to revivify indigenous tribal organizations as an agency in the regeneration of the land.

One result of the beginning of British rule in Kenya was a period of expansion during which rapid strides were made in the opening-up of new land at the expense of the forests. This process was checked by the marking of boundaries between 1905 and 1909 and the subsequent declaration of forest reserves. The shortage of fuel was solved for a time by the introduction of Wattle, but it was found that under certain conditions Wattle, far from improving the soil, may become a potent factor in increasing soil erosion. As a result, steps have been taken to lessen the acreage under this crop, while greater control of self-sown plantations will have to be ensured if Wattle is to take its rightful place in the farming economy. The Kikuyu are now alive to the desirability of tree planting. In 1943 the Nyeri Kikuyu bought some 30,000 trees and hedge plants from the Forest Department, and the local native council is now starting its own nurseries. These trees, however, are not being used for reafforestation in the true sense of the word, and many are being planted on land which should be under food crops instead of on waste land. In some areas, however, where original forest remains, its destruction is being voluntarily prohibited, and communal reafforestation has been done on Karema Hill. A scheme involving the planting of 200,000–350,000 acres of soft woods in the Crown forests would be financially sound, would provide much employment; and would have great advantages from the point of view of land conservation. Distrust of the Forest Department shows signs of lessening among the Kikuyu and if Forest Officers can win more of their confidence, one of the great obstacles to reafforestation in the past will have been removed.

97.3 (494) : 92 : 34.21. Bavier, B. Die Regelung von Wald und Weide in Graubünden. **[Forest and pasture regulation in Grisons.]** *Schweiz. Z. Forstw.* 96, 1945 (158–70). [G.] [2200].

A broad review is made of the relation between forestry and pasturage in the canton. Both types of husbandry are essential. Federal and Cantonal laws allow for the prohibition of grazing or its restriction by area or period: in practice this regulation applies chiefly to areas under regeneration, but, with the abandonment of clear felling and the tendency towards uneven-aged forest with a long regeneration period, the strict application of such restrictions means excessive concentration of grazing on the areas that are available. An effective settlement demands the enlargement and rounding-off of existing pastures, the thinning-out of trees on wooded pastures, the conversion of suitable areas of forest to pasture, and the closure of the remaining forest to grazing. Under present practice in Grisons the local forest officer is responsible for investigating the possibilities of planned management on these lines; any plan which he may propose is examined by the Canton Forest Inspectorate and, if approved, is negotiated with the communes concerned, final sanction being given by the local government. Only positive measures, whereby some forest is given up in compensation for the restriction of grazing in the remainder, or its total exclusion, provide a satisfactory solution. In conclusion it is stated that the Swiss Forest Society is proposing a revision of the article of Federal law governing pasturage. The draft proposals are that minor forest uses should continue in public forests only if non-injurious; pasturage of all domestic animals should be restricted in all forest except wooded pasture specially segregated for the purpose, and should be permitted on a restricted scale only by special permission of the Canton authorities; the cleaning of wooded and open pastures, if necessary to protect neighbouring forests from grazing, should be subject to the order of the Canton government; and the Federation should subsidize fencing for permanent regulation of pasturage.

97.3 (494) : 34.21. Widrig, J. Ausscheidung von Wald und Weide im Gebirge. **[Separation of forest and pasture in mountain areas.]** *Schweiz. Z. Forstw.* 96, 1945 (198–209 + plates). [G.] [2201].

Brief notes are included on a points system used by the Schweizerischer Alpwirtschaftliche Verein for allotting diplomas and prizes for good alp management, and on the rationalization of forest and pasture management in several different localities.

97.3 (71.4). Morais, L. La forêt ne doit pas servir de pâturage. **[The forest ought not to be used for pasture.]** *Bull. Minist. Terres For. Québec.* No. 8 (*n.s.*), 1944. pp. 44. [F.] [2202].

A brief statement, for the benefit of farmers, of the evils caused by grazing in forests and Maple plantations, a practice generally used in Quebec [cf. *For. Abstr.* 6 (47, 205)].

97.3 : 34.21 : 45.11 : 13.2. Maher, C. **The goat: friend or foe?** *E. Afr. agric. J.* 11, 1945 (115–21). [2203].

The article reviews recent literature on the goat, with particular reference to erosion, the control of thorn scrub, and deforestation. After discussing the arguments both for and against the goat, the writer concludes that in regions which have not already been badly overgrazed, goats, *in controlled numbers*, *may* be of assistance in preventing the regeneration of bush, but can do little but harm in districts where the bush is too high for the goats to browse and in overstocked areas where there is a struggle between goats and cattle for survival. On steeply sloping land and localities where afforestation is desirable, the activities of goats are definitely harmful owing to both the destruction of protective vegetation and seedling trees and the causation of erosion and soil slip by the animals scrambling up and down the slopes.

97.3 : 97.2. DenUyl, D. **Farm woodlands should not be grazed.** *J. For.* 43, 1945 (729–32). [Purdue Univ., Lafayette, Ind.] [2204].

The author summarizes the evidence from previous studies [see *For. Abstr.* 2 (255)] to show that grazing of livestock in farmwoods is not profitable and leads to progressive deterioration and ultimate destruction of the woods. In opposition to the recently issued Guides to Minimum Forest Practices, which permit controlled grazing, he holds that complete exclusion of livestock is essential for continued woods production.

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Argentina. Argentina is in the initial stages of organizing a federal forest service. One of the biggest projects is the establishment of a shelterbelt zone in central Argentina, where active dunes, often of several square miles, are forming. The project will require a combination of good soil-conserving practices such as shelterbelt planting, strip cropping, range re-seeding, and the use of specialized technique for dune fixation. In another area of sand dunes, in the south-east of Buenos Ayres Province, a dune-fixation project has been in hand for some 10 or 12 years. Among the species successfully planted are *Pinus maritima* and *Tamarix* spp. (**14**; Oct. 1945).

The Argentine Government recently instructed the Quebracho manufacturers to increase all wages by 30 per cent. As this has not been done Government threatens to impose the increase by decree. It is generally expected that, if such a decree is issued, the 18 factories in the country will close down immediately on the ground that the industry cannot support any further rise in production costs. Although local transport is severely restricted, considerable exports to North American and European ports took place in November and December and one consignment went to Sweden, the first since the end of the war. French companies in Le Havre are in the market for large quantities of Quebracho logs and have started negotiations with Paraguayan firms, but no orders have yet been placed. Total exports of Quebracho during the first 10 months of 1945 amounted to 192,136 tons compared with 135,878 in the same period of 1944. Of this quantity 25,955 tons went to the United Kingdom, 103,803 to the U.S.A. and 15,556 to France (**7**; 4.1.46).

Australia. A section of Wood Chemistry has been initiated within the Division of Forest Products, C.S.I.R. The work of this section is to cover a wider field of forest products utilization than has hitherto been possible. The work will include such matters as the possibility of producing turpentine from plantation-grown *Pinus caribaea*, studies on the essential oils, bark analyses for tannin content from experimental Wattle plantations, and studies on wood hydrolysis, wood distillation, etc. (**3**; Oct. 1945).

Some interesting figures were given recently by the Premier of Western Australia. Two states only, Western Australia and Tasmania, produce a surplus of timber above their needs. In Western Australia, 3,300,000 acres of land have been dedicated permanently as State forests, and production in post-war years will be about 12½ million cu. ft. of timber, valued at £2 million annually, providing work for about 5,000 people. It is expected that a production rate of 10 million cu. ft. will be maintained for at least 37 years (**20**; 2.2.46).

A large expansion in sawmilling has been planned in Western Australia. New sawmills will give direct employment to some hundreds of men and are expected to increase the population of the far South-west by 3,000 people (**2**; 1945).

The increasing importance of improved wood for commercial purposes has resulted in important developments of the processing industry in Australia. In the States of New South Wales, Victoria and South Australia several companies have already commenced manufacture, and others are taking steps to convert their plants to production of impregnated wood for which a wide variety of uses has been found. Well known Australian timbers such as Mountain Ash (*Eucalyptus regnans*), Coachwood (*Ceratopetalum apetalum*), Hoop Pine (*Araucaria cunninghamii*) and Kauri Pine (*Agathis* spp.) have been treated successfully, the veneers being coated with synthetic resin and then compressed and bonded at high pressure. Walnut (*Endiandra* spp.) and Maple (mostly *Flindersia* spp.) are being successfully used for the production of compressed, laminated boards for panelling, furniture and decorative fixture work (**9**; 1945).

Brazil. The Government in the State of Goyaz, Brazil, is installing some small mills for the extraction of Babassu (*Orbignya barbosiana*) nut oil. Millions of these trees in Goyaz cover an area of not less than 2,400 sq. km. There are also about 500 million trees in the State of Piauhy and some 78,000 sq. km. in the State of Maranhao. Exploitation has hitherto been on a small scale (**7**; 4.1.46).

British Guiana. The possibilities of establishing a paper-pulp industry in British Guiana are being explored. Investigations will cover detailed plans and estimates for a factory capable of producing 20,000 tons of pulp per annum from the plentiful Wallaba (*Eperua falcata*) (**7**; 7.12.45).

Burma. Very large quantities of lumber were used in making the 'Stilwell Road' in Burma; the species most used were Hollong [*Dipterocarpus pilosus*] and Makai [*Shorea assamica*]. The loggers always had to keep moving. The trees required were found only in patchy stands capable of producing about 500,000 to 700,000 bd. ft. of lumber per stand. As a group of men worked one stand, another group was out looking for others. Surveys were made either by elephant or by plane, the latter being the more satisfactory method. From the air, the long white stems of the Hollong and Makai stand out in bold relief from the immense green carpet of the jungle, and accessibility of the stands can also be determined quite accurately from the air (**18**; 1.10.45).

Canada. The Quebec Government have changed the scaling system of wood cut in Quebec from board measure to cubic foot measurement. An order in Council, on the recommendation of the Minister of Lands and Forests, has been passed to give effect to the change in method (**20**; 2.2.46).

The Quebec 4-H Clubs, modelled on similar American clubs, are designed to interest and instruct boys and girls in the fundamental principles of good forestry. There are now 75 such clubs in the Province with a membership of 2,500 and it is hoped to develop the organization on a large scale in the future (**12**; Nov. 1945).

The Forest Service, in collaboration with the Cine-Photographic service of the Province of Quebec, has made a coloured film entitled 'Nurseries and Reforestation' which will shortly be released. The first part shows all the work involved in raising young plants: seed collection and preparation, sowing, protection and tending. The second part shows the actual work of reforestation: transport of plants to the forest, planting, pruning, etc. It is hoped, later, to make films illustrating other phases of life and work in the forest (**12**; Jan. 1946).

An alarming increase in defoliation of Tamarack [*Larix americana*] by the European Larch sawfly [*Lygaeonematus erichsonii*] in Manitoba and Saskatchewan has been noted. In the early part of the present century much of the Tamarack in Canada east of the Rockies was wiped out by this sawfly, and the present outbreak threatens mostly new stands which have come up since then. The previous outbreak was stamped out by the introduction from Europe of the parasite, *Mesoleius tenthredinis*, which was released in the forests, and multiplied so fast that in a few years it was destroying 88 per cent. of sawfly cocoons. Investigations into the present degree of parasitism are being made (**4**; Sept.-Oct. 1945).

A pathological survey of Balsam Fir is being carried out in the Fort George Forest District, B.C. Spruce and Balsam stands are numerous in this area, and Balsam had been little exploited in the past. The possibility of a decrease in the timber resources of British Columbia and the projected establishment of a pulp manufacturing industry in the Prince George area have led to increased interest in the Balsam stands.

About 10,000 bushels of Douglas Fir cones were harvested in the autumn of 1945 on Vancouver Island and in the Fraser Valley of British Columbia by the Provincial Forest Service. The cones are gathered by local residents who are paid at the rate of $1·00 per bushel for green cones and $1·25 per bushel for dry cones. The cones are sent to an extraction plant and the seed then goes to the forest nurseries. During the past 3 years the Forest Service has set 10 million trees a year as its planting target on areas denuded by fire or logging (**19**; Oct. 1945).

As a result of long experiment in the utilization of sulphite waste liquor, Consolidated Paper Corporation has now put on the market a product called 'Copacite', which consists of powdered lignin extract obtained from such liquor. It has been found that a proper mixture of gravel, or stone and clay, with 'Copacite' makes a road bed with some of the characteristics of cement, which, when covered with a thin layer of asphalt, makes a compact winter-proof road. The Roads Department of the Province of Quebec has made exacting road tests in both summer and winter and has found that lignin extract applied in liquid form on road surfaces is effective in preventing dust, and that when used in powder form in a machine-mixed compound of stabilized gravel and clay, it increased the binding power of the clay to about one-third of the tensile and shear strength of concrete. 'Copacite' is applied at the rate of 10 tons to the mile of 22-foot roadway (**16**; Nov. 1945).

The Ontario Department of Lands and Forests, Division of Research, makes this analysis of water-dropping from aircraft.

During the summer of 1944, Mr. C. Crossley, pilot in the Departmental Air Service, revived the idea of dropping water from aircraft on incipient forest fires. Mr. Crossley rigged a tank in a Stinson Reliant float plane that could be filled by a water scoop while taxying. The water was manually released over the fire. Tests made in the fall showed that the 40 gallons of water in this tank gave the equivalent of 0·001 in. of rainfall on the sample area for one flight of the aircraft. In 1945 a more elaborate apparatus was attached to one of the new Norseman float planes. The rear compartment in each float was used as an automatic valve opened to admit water while the plane was taxying. Discharge was by manual control as before. The airworthiness, or control of the aircraft was not affected by the 100 gallons of water thus carried. Experimental fires were set in Oct. 1945, in a slashed area to test the effectiveness of the method. Relative humidity was high and the temperature and wind were both low, a combination most favourable to the success of the test. It was found that the valve mechanism worked smoothly but that the water discharge was probably too slow. The shattering effect of the air stream on the water mass caused a large part of it to be uselessly dissipated even under the favourable weather conditions prevailing. There was difficulty in hitting the target area with the falling water.

It has been established that: (1) water is useful quantities can be transported quickly to a small fire, (2) the utility of the aircraft is not seriously impaired by the additional equipment. Further work is necessary to improve the rate of discharge and the placing of the water load on the ground. There is a decided probability that this mechanism may have a place in applying insecticides to small areas where infestations may be starting and the use of a heavier craft or larger quantities of liquid may not be desirable. The additional work necessary on this device will be carried on by Mr. Crossley under the Research Division (**19**; Feb. 1946).

Chile. There are now 3 plywood factories in Chile, which together manufacture about 400,000 cu. ft. of plywood annually. Woods generally used are Coigue (*Nothofagus dombeyi*), Rauli (*N. procera*), and Chilean Laurel (*Laurelia aromatica*). Chilean Pine (*Araucaria imbricata*) is also used. The bulk of the plywood manufactured is three-ply in thicknesses of 3, 4, 5, and 6 mm. (**18**; 15.12.45).

Costa Rica. A legislative decree of 29 August, 1945, converts the area along the route of the Inter-American Highway into a national park. Forest leases and exploitation licenses will not be granted for public lands within 2,000 metres on either side of the highway where there are stands of Oak, and any privately owned lands having stands of Oak within these limits may be expropriated by the Government. As many forest-ranger posts as may be necessary for proper conservation and supervision of the park are also authorized by the decree (**11**; 29.12.45).

Finland. Production of lumber in the year 1945 was a considerable improvement on that for 1944. The following table shows the total export quantities, including reparation deliveries, of the principal export goods:—

		1944	1945
Pitprops (solid measure) .	cu. m.	139,075	267,300
Sawn timber, soft . .	stds.	130,670	213,848
Sawn timber, hard . .	stds.	438	284
Prefabricated houses . .	tons	46,077	71,179
Plywood	cu. m.	59,813	72,416
Wooden spools and bobbins .	tons	1,432	1,505

The transport task is gigantic. In addition to this year's felling programme, 6 million cu.m. were left in the woods last year, so that altogether 58 million cu.m. have to be conveyed—an unprecedented quantity in Finland. Part of it will have to be left over, as timber felled in April and May can no longer be got out (**20**; 9.2.46).

France. Automatic operation is claimed for a system developed in France for the protection of vineyards and similar crops against damage from frost. The cost of installation at present exchange rates is about $120 per ha. Electrothermal couples are used in conjection with fuel-oil burners. A galvanometer registers the temperature of pilot thermocouples on the buds or leaves of plants in areas to be protected, and a switching device, activated by a thermometer, controls the flow of electrical current. When the temperature drops to a critical level, the switching device alters the flow of the current so that it passes through resistance elements in proximity to wicks in various fuel-oil burners, and results in combustion and generation of smoke (**11**; 2.2.46).

A new method of preserving telephone and telegraph poles has been developed in France. An 8-per-cent. solution of copper sulphate is applied to the butt ends of the poles by gravity pressure, and impregnation takes place through the entire length. It is claimed that the method prevents decay for a period of 10 to 12 years. Scots Pine is preferred, and within 5 days after cutting the trees are hauled to a yard where they undergo treatment. If treatment is delayed impregnation is rendered difficult by the flow of pitch over the cut surfaces. The poles are arranged side by side in a single row on an inclined platform on a gradient of about 5 per cent. with the butt ends at the higher level. The solution is pumped into storage tanks, nozzle plates are clamped to the butt-ends of the poles after removal of a thin slice of wood, and treatment is started by opening valves that control the flow of the copper-sulphate solution through pipe lines to the nozzle plates. The treatment period for poles under 35 ft. long is about 5 days, and for the longer poles 15–20 days. After treatment the bark is removed. Use of Scots Pine 25–50 years old, which has little or no heartwood, facilitates a more complete impregnation. The season of the year when the timber is cut seems to have no influence on the ability of the wood to absorb the solution. There are 67 yards in France using this method of treatment of poles and they operate throughout the year (**11**; 23.2.46).

Germany. The German forests have not been badly overcut. There was some increase in the annual cut during the war, but the average was not more than 30 per cent. overcut. The greatest damage was due to bombing, clearing for air strips, and a bad wind (the worst for 400 years) in 1934. The Scots Pine plantations are interesting, as all are underplanted with hardwoods, Beech and Oak. This is done for two reasons: because the two types grow well together and make more wood per acre, and in order to convert to hardwoods when the Pine is removed (**14**; Dec. 1946).

Great Britain. In an address to the Home Timber Merchants' Association at Glasgow last month, Mr. Tom Johnson, chairman of the National Committee for the Operation of the New Forestry Act in Scotland, said that the Forestry Commission are at present 'actively interested' in 55 wartimes camps which they hope to use in meeting the problem of housing workers for the expanded national programme of afforestation. The afforestion target of 5 million acres in 50 years would eventually provide employment for a quarter of a million men (**23**; Jan. 1946).

Impregnated plywood moulded in tubular form is far stronger than the old-fashioned galvanized pipe. When used with long rhombics, plywood masts can withstand a horizontal pull of 10,000 lb. Built for ultra-high-frequency arrays they have successfully passed tests with 300 lb. at the head. A 55-ft. mast weighs only 200 lb. when packed for shipment. The sections are arranged to telescope into each other and can be packed in sections 12 ft. long. They are easy to assemble or dismantle and can be erected over and over again. A further advantage of these masts of moulded plywood is their cheapness (**20**; 11.2.45).

Guatemala. The result of the first auction sale of 100,000 Mahogany trees was announced on 25 February. The sales price resulting from the highest bid was fixed at $25·31 for each tree to be cut.

Forest fires have been reported in various parts of the Republic. Officials of the recently organized Forest Service are making a determined effort to control the customary practice of cleaning fields and pastures by burning (**11**; 30.3.46).

Haiti. Forests of commercial importance are almost non-existent in Haiti. Small stands of Pine, Logwood, Lignum-vitae and Mahogany still exist in isolated spots, but the total area of these does not exceed 2,000 sq. km. Most of this is located in the Pine forests of the La Selle Mountains in the south-east and the more accessible mountains in the north. A general survey of the country indicates that most of the stories of former vast timber resources of Haiti were probably greatly exaggerated. The only valuable timbers now remaining in quantities worth attention are the Logwood or Campeche (*Haematoxylon campechianum*), Lignum vitae, and West Indian Pine (*Pinus occidentalis*). Mahogany is still found in isolated spots, and most of the local furniture is made of it, though it is evident that most of the mahogany is from young trees with an excessive proportion of sapwood. Cedar is practically extinct on the island (**11**; 5.1.46).

Holland. A plan for the rehabilitation of the famous woods between The Hague and Scheveningen has been inaugurated by the city authorities with the planting of the first of some 200,000 young trees. The woods were destroyed by the Germans when they transformed The Hague and Scheveningen into a part of the 'Atlantic Wall'. The young trees will be planted by the school children of the city under the supervision of the Department of Parks. It is planned to fill the ravaged space with Poplar, Willow, Birch, Beech and Oak. The young trees will be given into the special care of the children. The ceremony of the first tree planting took place on 5th November, 1945 (**1**; 15.1.46).

Honduras. On the south coast of Honduras, between the Inter-American Highway and the gulf of Fonseca, a large sawmill with a capacity of 500,000 bd. ft. a month has begun operations and, besides sawn timber, large quantities of timber suitable for mine props and piling are being produced. Most of the Pine timber from Honduras has been exported to Panama, but in February the first shipment was made to the United States (**1**; 30.3.46).

Iceland. The chief of the Iceland State Forest Service recently visited Alaska to study forestry on Prince William Sound and in the Kenai Peninsula, where conditions are similar to those in Iceland. Iceland has natural forest areas of Larch, Birch, Mountain Ash and Willow, and it is hoped to establish some American coniferous species such as Sitka Spruce and Hemlock. Most of the timber for domestic needs is at present imported from Sweden and other Baltic countries (**21**; Nov. 1945).

Italy. With the liberation of Northern Italy, one of the most pressing problems in reconstituting the Corpo delle Foreste, the Italian Forestry Corps, has been the lack of forest guards. A new training school has, accordingly, been set up at Piazzatorre, Bergamo Province, for the training of forest guards. The first session, which opened on 1st August, 1945, was scheduled to last for 4 months and courses were planned in dendrology, planting, pasture management, forest law, etc. There is a staff of 9 and about 320 students, almost all ex-partisans (**14**; Nov. 1945).

Japan. A policy of sound forestry has been practised by Japan since the period when she began to build up her forest resources. Little is known of the extent of the forests of the country; about 40 per cent. of her timber requirements were supplied from Manchuria. The main uses of wood are thin boards and paper for houses, pulp for paper and rayon, and wood for charcoal, the principal source of domestic heat. Before the war Japan was second only to the United States in the *per capita* use of wood. An intensive 6-months survey of the forests and forest industries of Japan and of Korea is at present being conducted by three United States foresters (**21**; Feb. 1946).

Kenya. The Eucalyptus Snout Beetle (*Gonipterus scutellatus*) has made its appearance in Kenya. As soon as the beetle had been identified, steps were taken to introduce its egg parasite from South Africa, and arrangements have been made to breed the parasites on a small scale at the Scott Agricultural Laboratories (**8**; Dec. 1945).

Mexico. An experiment in scientific exploitation of certain deciduous hardwoods has been initiated by the Mexican Ministry of Agriculture. A 50-year concession is granted by Presidential decree to a lumber company for the development of a large area of woodland and the operation of a kiln-drying plant. Mexico is believed to possess hardwood resources large enough to meet the entire domestic demand and leave an exportable surplus, if processing facilities are made available (**11**; 5.1.46).

The railways of Mexico have experienced great difficulty in recent years in procuring adequate supplies of sleepers. It is now proposed that the railways should acquire and administer timber lands of sufficient size to produce their annual sleeper requirements on a sustained yield basis. It is estimated that 250,000 acres would be required for this purpose (**21**; Nov. 1945).

New Zealand. The latest statistics available from the Government Statistician show that the total production of sawn timber for the year ended 31st March, 1944 was 351 million bd. ft. It is believed that that for the following year will prove to be only 341 million bd. ft., the reduction being due to severe shortage of labour (p. 13) (**15**; 1945).

Sierra Leone. Two instances of trees in West Africa, which had been felled to the ground by storms, rising again of their accord, have been described by a contributor to the *Sierra Leone Daily Mail*. One of them took place at Ekuigbo, Ugheila in Nigeria, in June 1945, and the other, which the writer witnessed personally, was in Freetown about 1891. The explanation was that in each case the main root had remained firmly embedded in the ground. The tree was subsequently denuded of its branches, which were taken for firewood, and this lessening of the weight caused it to spring back into place. Many people in the neighbourhood, however, preferred a different explanation: that a devil had his habitation under the tree and he had pulled it back (**8**; March 1946).

Spain. A plant for the extraction of sugar from wood is to be built in the Spanish province of Galicia. The plant will cost 2 million pesetas, and annual production is estimated at 50,000 tons of sugar (**7**; 7.12.45).

Sweden. In a recent demonstration, a jeep was used to pull a fire-fighting trailer carrying 500 litres of water and weighing about a ton with accessories. The combination is capable of cross-country work, but would naturally be of greatest use in southern and central districts with a well developed network of roads (**17**; 15.12.45).

Prospects of timber exports in the coming year depend chiefly on the possibilities of obtaining coal and coke in sufficient quantities to free labour from fuelwood production. Sales of timber goods for the year ending 31st March 1946 amount to 1,400,000 stds., of which 650,000 represent domestic consumption, and of the remaining 750,000 stds. for export, about 675,000 are sawn and planned goods and boxboards, the remainder being spars, round timber and timber goods used in wooden houses intended for export. Reserves of timber in storage have been used up, so that sales for 1946 will have to be met from the quantities actually converted during the year (**17**; 15.1.46).

The State Forestry Research Institute is supporting part of a report by the Norrland Committee of Enquiry asking for official regulation of the forest seed trade, which is at present not controlled, and has outlined the chief requirements as to quality and provenance that need to be satisfied (**17**; 15.2.46).

Switzerland. The enormously increased demand for fuelwood, both for industrial and domestic purposes, has led to organized salvage operations, consisting in part of re-logging of felled areas, and in part of collection of dead wood and felling in remote valleys not hitherto economical to exploit. The wood so produced is known as 'bois d'épave', and is cut up into 10 cm. billets. Up to the end of 1944, about 250,000 stacked cu. m. of this wood had been produced, mostly in the canton of Grisons. A great extension of this form of exploitation took place in 1945, and much equipment has been installed in the form of cableways, telphers, tools, lorries, etc. (**13**; December 1945).

Turkey. Two paper factories in Izmir, Turkey were expecting to increase their present output of 20,000 metric tons last year. A third plant is to be built at Izmir with an annual output of 16,000 metric tons. Izmir will also be the site of a new factory for the manufacture of insulating materials from wood shavings and sawdust, with an annual capacity of 6,000–7,000 metric tons (**6**; 20.10.45).

United States. The results of research recently completed by chemists at Ohio State University and published in *Industrial and Engineering Chemistry*, indicate that concrete will last much longer and with far less maintenance expense if calcium lignosulphonate, a lignin product made from paper-mill waste, is added to the cement used. The calcium lignosulphonate disperses the cement particles by electrostatic action and tests show that concrete produced with dispersed cement is stronger, less porous, and lasts 4 or 5 times longer than that made with plain cement (**16**; Sept. 1945).

As the root system of Jack Pine spreads close to the surface, an ordinary bulldozer cannot remove the tree in a single movement, as the roots would come up under the blade, making it necessary for the operator to reverse and make a second forward movement. This difficulty can be overcome by attaching a protruding bar to the bulldozer, to strike the tree at a point high above the base and tip it over ahead of the blade in a single movement (**10**; 6.12.45).

The U.S. Dept of Agriculture has recently announced the development of a simplified method of treating fenceposts, etc. Freshly cut saplings are allowed to stand in a wooden tub or trough containing the right amount of chemicals in solution for about 6 hours or until they have taken up the required amount. Chemicals recommended are chromated zinc chloride, zinc chloride, and copper sulphate. Chromated zinc chloride is the best; it protects the wood longer and is less corrosive to wire staples than copper sulphate. One pound of any of the chemicals dissolved in half a gallon of water will treat a sapling which measures 4 in. at the base and is 30 ft. tall. Best results are obtained when the saplings are treated immediately after cutting from the stumps. When this is not possible, about one inch should be sawed from the cut end immediately before treating, to permit the solution to enter the sap stream. Many kinds of both hardwood and softwood saplings or trees of a size easily handled can be treated by the sap-stream method. The treatment is best applied during the spring and summer, particularly on bright sunny days when the sap flows most rapidly. Deciduous hardwoods can be treated only from early spring to late summer. Pines can be treated at any time except during frost. Evergreens, treated in winter, require about a day to take up the necessary amount of solution (**1**; 15.12.45).

The Westinghouse Electric Corporation has opened a laboratory at Los Angeles for research in the application of high-frequency heating to industry. Plywoods made up of as many as 148 layers of Birch veneer and measuring over a foot thick have been made, using phenolic-resin adhesives, and cured dielectrically in a few minutes. Many-layer plywoods made in this manner have tested tensile strengths of 45,000 lb. per sq. in. but weigh only half as much as equally strong aluminium (**21**; Oct. 1945).

A new resorcinol resin glue, named *Cascophen*, has just been released by the Casein Co. of America. Invented in 1943, and used extensively in construction for war purposes, the new adhesive has been found effective in bonding almost any material with some degree of porosity. It will develop a boil-proof, completely durable, phenol-resin type bond at ordinary room temperatures. It is sold as a dark wine-coloured liquid adhesive with a separate powdered catalyst. *Cascophen* possess high strength, even in a thick film and is adaptable for use on sawn surfaces or on joints which may not be perfectly fitted (**21**; Dec. 1945).

Monthly planting of about a quarter of a million Douglas Fir and Port Orford Cedar seedlings is part of the programme now being planned for reforesting the Tillamook Burn area. The Miller mechanical tree planter, developed by S. L. Miller of the Oregon State Forestry Department, will be used in this work. Using this instrument, inexperienced men have been able to plant trees at the rate of 150 an hour, and an experienced hand has planted as many as 250. Experiments will also be made in direct sowing both by hand and from an aeroplane (**21**; Nov. 1945).

Exhaustive tests of helicopters in fighting forest fires are to be made in the first months of this year by the U.S. Air Force and Forest Service. Tests will be made to determine the practicability of transporting Forest Service Fire fighters and equipment to the scene of the fires, and discharge and pick-up of fire fighters by means of rope ladders raised and lowered on hoist lines. Other contemplated uses are for fire detection, and patrol, game and cattle counts, sowing of grass seed on burned-over areas, photographic and map work, and stocking of remote mountain lakes with fish. Ability of the helicopter to hover above the ground at hights of 300 to 100 ft. will be tested (**21**; Jan. 1946).

In accordance with instructions from the American Forest Products Industries Hardwood Research Committee, equipment has been procured for a pilot plant for research into processes for converting hardwood wastes into fibrous products. Processes for producing paper, cardboard, and building board from hardwood wastes will be investigated. It is desired to develop an American process, using American forest produce. The market is greatly influenced by an influx of foreign pulp, chiefly from Sweden (**14**; Oct. 1945).

The North Carolina Board of Conservation and Development have adopted a resolution asking federal authorities to consider making the Great Dismal Swamp in the north-east of the state a national forest. Formerly 2,200 sq. miles in extent, it has been reduced to 750 sq. miles by drainage. It contains dense forests of Bald Cypress, Black Gum and Juniper. Fire has ravaged the area continually and in some places the peat has been burned to a depth of 10 ft. or more. In 1923 a fire was started by lightning and continued to burn until 1926 (**14**; Nov. 1945).

The American Forestry Association has decided to call on the American Forestry Congress to consider the present national forestry situation and formulate an effective post-war forestry programme. The conference will probably be held at Washington about September, 1946, by which time it is hoped that the Association's Resource Appraisal will be completed (**14**; Dec. 1945).

The College of Forestry of the University of Washington is embarking on a research programme to provide information on seed production of Douglas Fir and other species that thrive in the north-west. The studies will include the principles of seed heredity and an analysis of 30 years' records of Douglas Fir seed study by the Pacific Northwest Forest and Range Experiment Station. The experience of foresters in Australia, New Zealand and Europe, where Douglas Fir seed has been introduced, will also be studied (**14**; Jan. 1946).

Central Aircraft, Inc., Yokima, Washington, are carrying out an experiment on 600 acres of the 1945 Salmonberry burn, for simultaneous poisoning of rodents and sowing of tree seeds from the air, which they have contracted to do at $2·0 an acre. One of the main objects is to determine whether aerial sowing of forest tree seeds will be effective on new burns. The site selected is well suited for the purpose, as it gives all aspects, has considerable differences of elevation, and is of varying intensities of burn. A mixture of Douglas Fir, Port Orford Cedar, Hemlock, and Spruce seed is being used (**5**; February 1946).

Mr. L. A. Isaac, Associate Silviculturist at the Pacific Northwest Forest and Range Experiment station, has been granted 6 months' leave of absence, from Dec. 1945 to May 1946, to be spent at the University of Washington, Seattle, where he will collect and collate all existing data on forest tree seed selection that are available in the United States or that have been published in the literature of foreign countries. He is also making a preliminary investigation of the various strains of Douglas Fir, in order to lay the groundwork for future studies in tree-seed selection. This work is of prime importance to owners of timber in the Douglas Fir region, where the necessity for great care in the selection of seed for future forest growth has not been generally recognized (**22**; 1945).

The latest estimate of the bear population in Alaska's two National Forests is 13,000 animals (8,000 black bears and 5,000 brown or grizzlies). Brown bears have chewed up so many wooden road and other signs that it has become necessary to develop some type of bear-proof guide post. They have recently wrecked or damaged several Forest Service boats; in one instance, a bear broke up a boat and a family of bevers used the pieces in the construction of a dam (**14**; April 1946).

U.S.S.R. In the part of the Soviet Union occupied by the enemy during the war, 1,300,000 ha. of forest must be restored. By October 1945, about 56,000 ha. had already been replanted, and a further 100,000 ha. are expected to be replanted in the spring of 1946. The area reforested each year will be gradually increased until it reaches 200,000 ha. in 1948. Pine, Oak, and Spruce will be the most widely distributed species, and Poplar will be planted in the river valleys. Larch, which provides timber suitable for sluices, dams and other hydraulic works, will also be planted. The Amur Velvet tree [*Phellodendron amurense*], the bark of which is used for cork, and Walnut will be planted in the Ukraine and the Crimea. *Euonymus verrucosus* will be sown extensively for the production of gutta percha (**11**; 19.1.46).

Re-sowing of forests from aircraft to supplement planting, was resumed in 1945. This spring, an area of about 100,000 ha. will be sown in this way. More than 500 million trees were planted in the U.S.S.R. in 1945 and it is planned to plant 1,000 million in 1946 (**11**; 19.1.46).

The Ukrainian S.S.R. is rich in forests, particularly in its western and northern regions. Merchantable volume is estimated at 149·5 million cu. m. The timber industry was highly mechanized and had an annual output, before the war, of 11 million cu. m. of logs and firewood, 2·5 million cu. m. of sawn timber, and a large volume of machine parts, doors, parquetry, plywood, furniture, and chemical products. There were 86 lumber camps with railways and their own motor transport and horses, and 213 sawmills and wood-working plants. The timber industry was ruined by the Germans and only 22 out of its 213 wood-working industries remained. It is now being rapidly restored. 560 miles of narrow-gauge railway and all the lumbering enterprises have been restored. the industry has acquired 35 locomotives, 310 special trucks, and 8,000 horses. Under the new 5-year-plan it is proposed to produce this year 860,000 cu. m. of sawn timber and a large quantity of furniture (**20**; 20.4.66).